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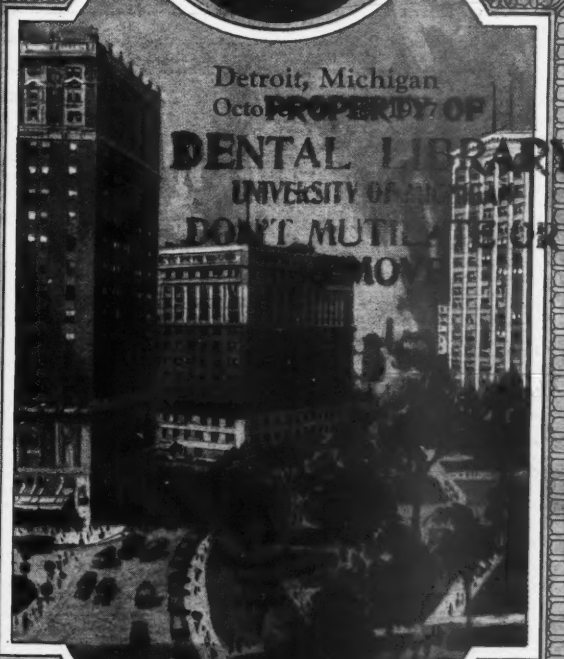

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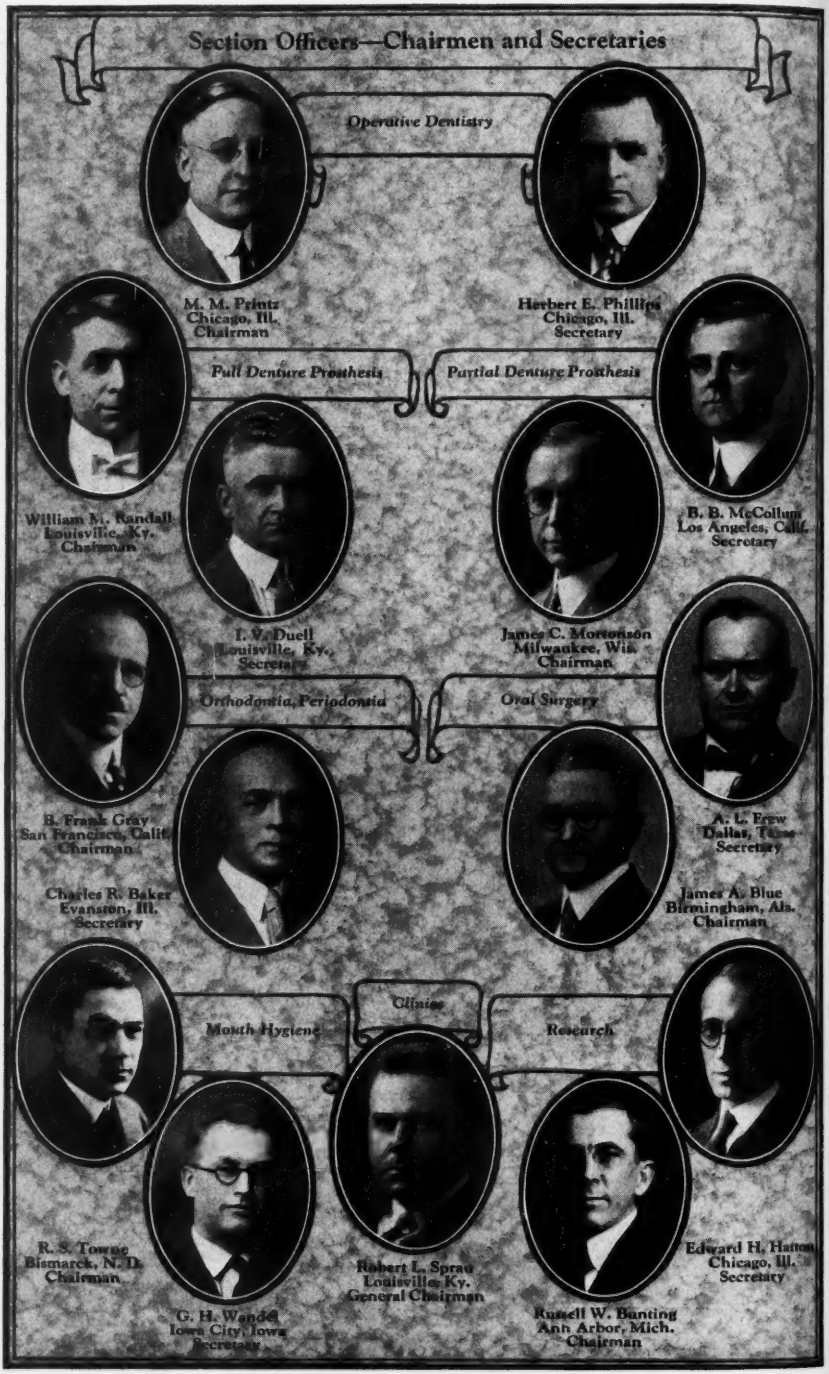

SECTION OFFICERS (CHAIRMEN AND SECRETARIES), SIXTY-NINTH ANNUAL SESSION, AMERICAN DENTAL ASSOCIATION, DETROIT, MICH., OCT. 24-28, 1927

THE JOURNAL
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Original Communications

BRONCHOSCOPIC CASES OF DENTAL INTEREST: DENTAL FOREIGN BODIES IN THE AIR AND FOOD PASSAGES*

By CHEVALIER JACKSON, M.D., Sc.D., F.A.C.S., Philadelphia, Pennsylvania

FROM the mass of clinical material at the Bronchoscopic Clinic, I have selected for presentation certain cases that seem to me to have phases of especial interest to the dentist. At the onset, I wish to disclaim all knowledge of dentistry except that acquired as a patient. Clinical facts, are, however, always of value to the dentist as they are to the physician; and it is only a group of clinical facts, with a few germane comments, that will be presented herein.

Our dental cases may be grouped as follows:

Group A: Bronchopulmonary suppuration resulting from diseases of the teeth and alveoli. These will not be considered herein.

Group B: Pulmonary complications following dental procedures, but unassociated with a foreign body. These cases will be briefly considered.

Group C: Foreign body accidents directly connected with dental procedures.

Group D: Foreign body accidents of dental interest but not directly connected with a dental procedure.

Groups C and D will be considered together apropos of particular classes of foreign bodies.

*Read before the Section on Operative Dentistry at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 25, 1926.

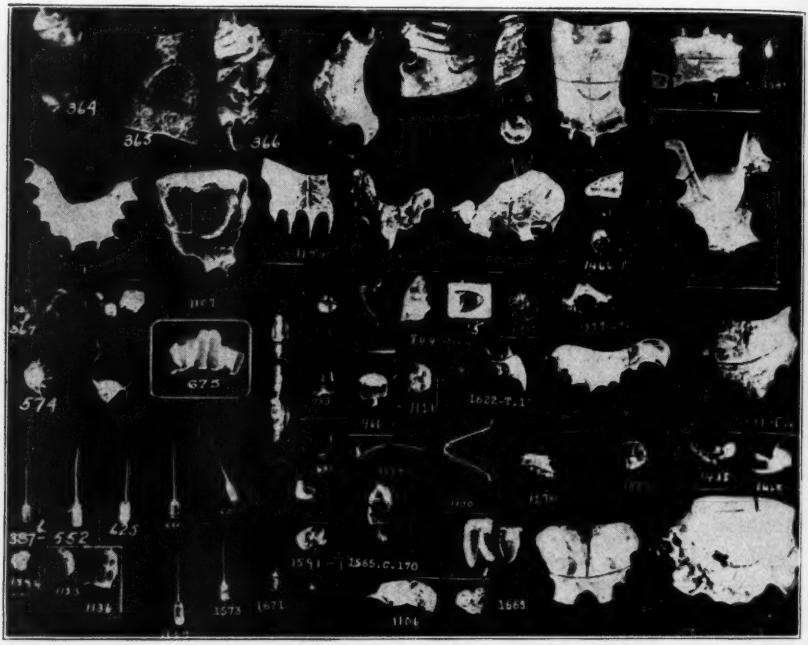

Fig. 1.—Dental objects removed from the air and food passages by bronchoscopy and esophagoscopy through the mouth at the bronchoscopic clinic.

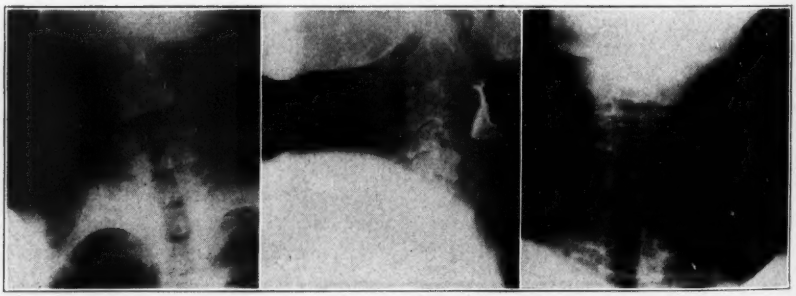

Fig. 2.—Case in a man, aged 53, showing a dental plate in the cervical esophagus. It had been dislodged and passed downward during an epileptic seizure.

PULMONARY COMPLICATIONS UNASSOCIATED WITH FOREIGN BODY

The group B cases are parallel, in clinical character as well as in the overlooking, to posttonsillectomic pulmonary complications, which have proved so numerous since the attention of tonsillectomists was called to the matter by

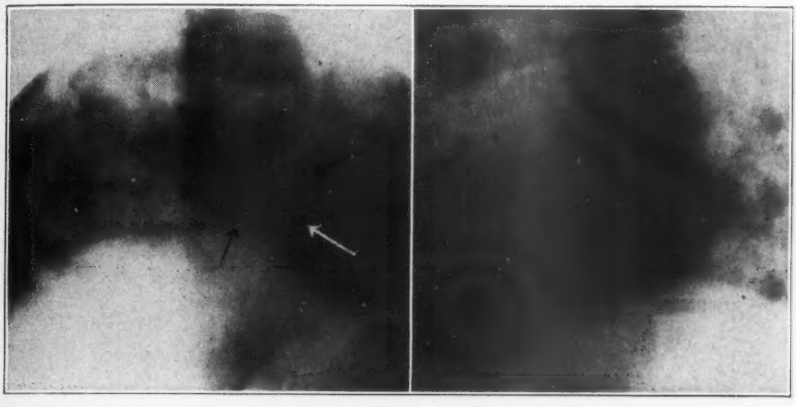

Fig. 3.—Case in a man, aged 32, showing a dental plate in the esophagus, just above the diaphragm. The clamp of the denture was broken off and the defective plate passed downward while patient was eating.

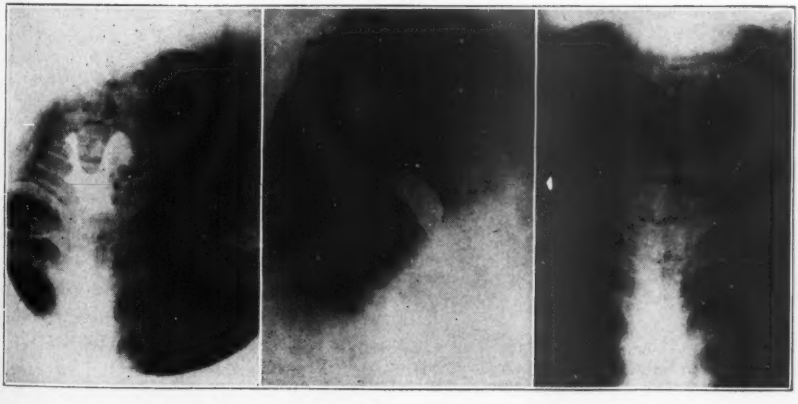

Fig. 4.—Case in a man, aged 40, showing an artificial denture in the esophagus at the level of the suprasternal notch. It has passed downward during the unconsciousness of an epileptic attack.

Charles W. Richardson.[1] As pointed out by him and corroborated by Moore,[2] these suppurations probably arise from infective material inspirated during the operation; but as shown by George Fetterolf[3] and Fetterolf and Fox,[4] the lymphatic and hematogenous routes are direct, and there is much clinical evidence that a certain as yet undetermined percentage are due to infective emboli from the field of operation. In some of the dental postoperative and posttonsillectomic cases unassociated with foreign body that have come to the Bronchoscopic Clinic for diagnostic or therapeutic bronchoscopy, Dr. Willis F. Manges has been able to determine by which of the two routes (vascular or aerial) the infective materials have probably reached the lungs; but, in the postdental, as in the posttonsillectomic cases, though the route is unproven, there is no question as to the etiologic connection between the operation and lung suppuration.

The subject is too large for full consideration here and must be dismissed with three suggestions:

1. In all dental operative procedures, when it is feasible the aspirator should be kept going. This applies especially to cases in which any form of reflex-obtunding anesthesia is used; but, when practicable, it would be well to use oral aspiration in any kind of case. Doubtless, it is not routinely practicable.
2. Early diagnosis renders possible early bronchoscopic aspiration.
3. Bronchoscopic aspiration, if done

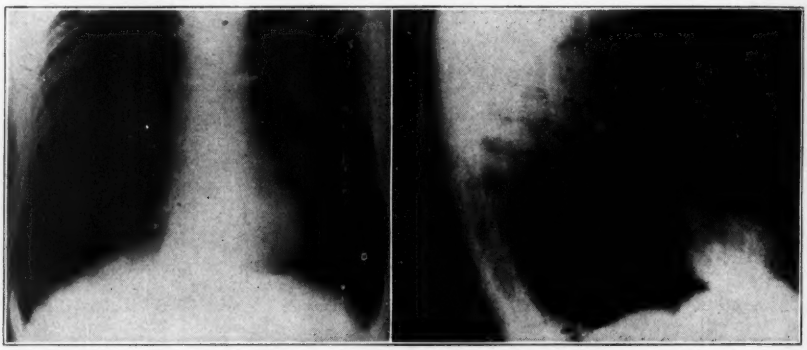

Fig. 5.—Case in a man, aged 52, showing a small partial denture in the left main bronchus. The dentist was attempting to fit it on the upper jaw when it slipped from his fingers and was aspirated. It was thought to have been swallowed. Pulmonary symptoms developed. A roentgen-ray examination, two weeks after the accident, showed the foreign body in the lung.

1. Richardson, C. W.: Tonsillectomy with Consideration of Its Complications, Washington Med. Ann., 11: 85, 1912.

2. Moore, W. F.: Pulmonary Abscess. An Analysis of Two Hundred and Two Cases Following Operation Work About the Upper Air Passages, J.A.M.A., 78: 1279 (Apr. 29) 1922.

3. Fetterolf, George: Safeguarding of Tonsil and Adenoid Operation, Am. J. M. Sc., 164: 884 (Dec.) 1921.

4. Fetterolf, George, and Fox, Herbert: Reaction of the Paratonsillar Tissues to Tonsillectomy, Am. J. M. Sc., 166: 802 (Dec.) 1923.

early, will, in many instances, prevent chronic pulmonary abscess and bronchiectasis, with all their grave consequences.

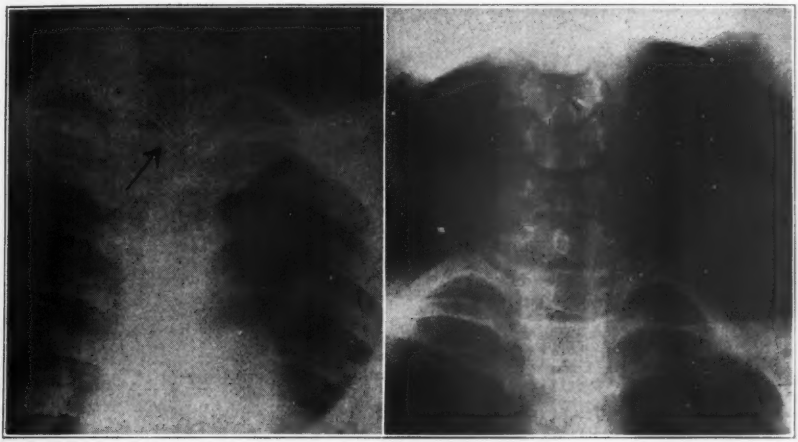

Fig. 6.—Case in a woman, aged 23, showing an orthodontic appliance in the esophagus at the level of the suprasternal notch. The patient had not properly secured one of the ends, and it passed downward while she was eating ice cream.

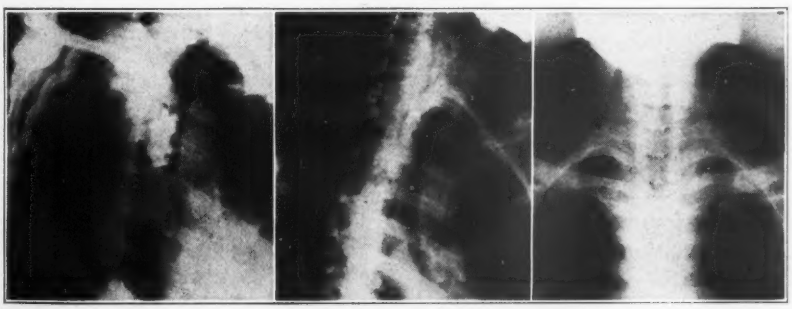

Fig. 7.—Case in a woman, aged 47, showing a denture in the upper thoracic esophagus. A holding clamp had been broken, and the denture passed into the esophagus while the patient was asleep.

FOREIGN BODY ACCIDENTS

Of the 1,728 foreign bodies removed from the air and food passages at the Bronchoscopic Clinic, seventy-one have been classed as dental objects. These may be classified as follows: teeth, whole or fragmentary, filled or unfilled, 24 cases; dentures, whole or fragmentary, 20 cases; broaches, 9; fillings with and without attached fragments of teeth, 7; gold crowns, 4; braces, 3; bridges, 2; alveolar fragments, 2; total, 71 cases.

Frequency.—As I have frequently stated,[5] the relative rarity of dental foreign body accidents is a great tribute to the care, foresight and skill of the men who do so much work at the yawning funnel-like entrance to our air-and-food passages, in which there are at all times forces, physiologic and gravitational, potentially active to draw into the patient's anatomy any small movable object. Nevertheless, the frequency of this occurrence may be greater than is suspected. The presence of a foreign body as a cause of pulmonary suppuration is relatively often overlooked.[6] Many of our cases of teeth in the lungs were quite unsuspected by dentist and medical practitioner alike until incidentally revealed by a roentgen-ray examination made for general diagnostic purposes. Many of these patients were nearly dead of lung suppuration. This leads to the inference that many other patients died of pulmonary suppuration

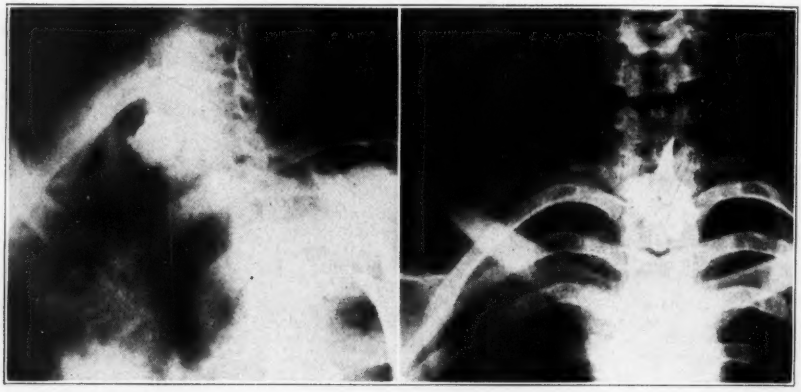

Fig. 8.—Case in a woman, aged 46, showing an artificial denture in the esophagus at the level of the suprasternal notch. The denture was lost downward during eating.

Fig. 9.—Case in a man, aged 35, showing a denture in the hypopharynx. It was being worn as a temporary plate and was lost downward during sleep.

5. Jackson, Chevalier: Peroral Endoscopy (textbook), 1914; also published in abstract, "Bronchoscopy and Esophagoscopy," Philadelphia, W. B. Saunders Co., 1926; "Root-Canal Broach Removed from the Lung by Bronchoscopy," Dent. Cosmos, 57: 247 (March) 1915; Root-Canal Broaches in the Lungs, Dent. Cosmos, 68: 449 (May) 1926.

6. Jackson, Chevalier: Overlooked Cases of Foreign Body in the Air and Food Passages, Brit. M. J., 2: 686, 709 (Oct. 17) 1925.

without the presence of a tooth in the lung being suspected as a cause. Even when roentgen-ray examinations have been made, the presence of a tooth may in the lungs because of the "overlooking of the obvious" that I have done myself. If anyone had asked me, twenty years ago, when I ceased doing tonsil opera-

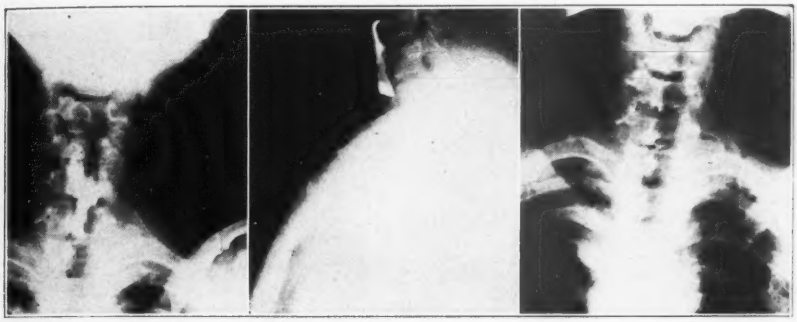

Fig. 10.—Case in a man, aged 25, showing a metallic partial upper denture. One of the retention clasps had been broken off. The denture became loosened while patient was eating, and passed into the upper esophagus.

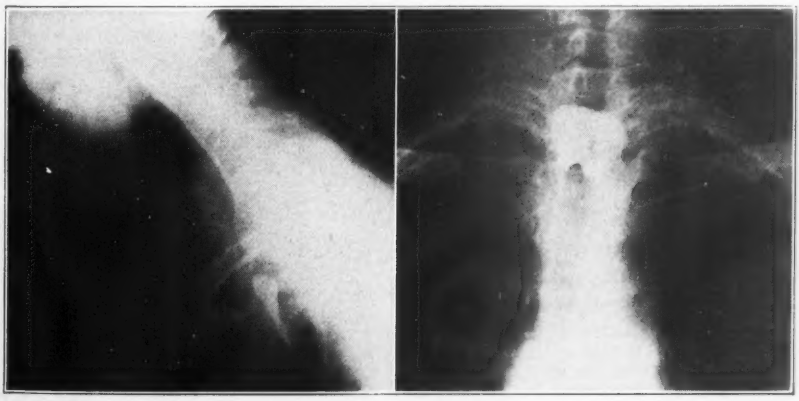

Fig. 11.—Case in a man, aged 42, showing a large denture in the upper thoracic esophagus. It had become loosened and passed into the esophagus while the patient was intoxicated.

have been overlooked. Dr. Manges, who is to discuss this phase of the subject, will tell you how this occurs. I feel well-qualified to speak of the matter of overlooked cases of teeth tions, if I had ever had pulmonary abscess as a sequel, I should have replied that I had never seen such a case; but since the discovery by Charles W. Richardson[1] of the etiologic relation of

tonsillectomy to pulmonary abscess, I have recalled cases in which I overlooked the sequence.

7. Postoperative lung suppuration, embolic or inspiratory, unassociated with foreign body.

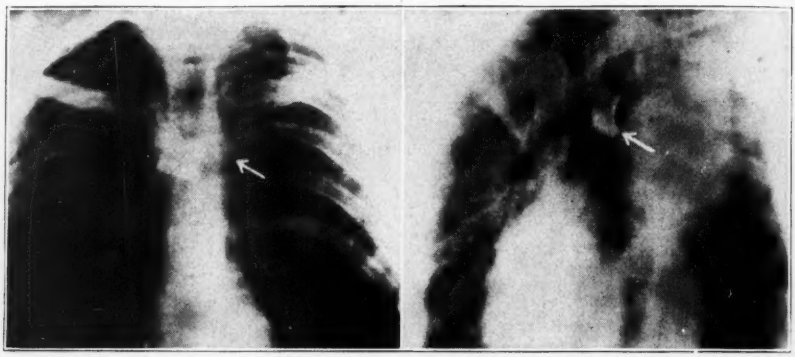

Fig. 12.—Case in a man, aged 35, showing a large upper denture in the midthoracic esophagus. During a coughing attack, the denture became loosened and passed into the pharynx. Blind attempts at removal resulted in the passing downward of the denture into the midthoracic esophagus before the patient's admission to the Clinic.

ETIOLOGY OF DENTAL FOREIGN BODIES IN THE AIR AND FOOD PASSAGES

Our cases showing etiologic factors connected with dental procedures may be grouped as follows:

1. Teeth or fragments inspirated into the lungs during extraction.
2. Fillings alone or with portions of tooth attached similarly inspirated.
3. Dental instruments or parts inspirated by the patient while in the chair.
4. Dental apparatus or orthodontic appliances or materials similarly inspirated.
5. Dental appliances, or loose deciduous or adult teeth inspirated during surgical procedures other than dental.
6. Artificial dentures inspirated or swallowed, usually during eating, or while the patient was unconscious from pathologic causes or from natural sleep.

It is unnecessary to consider separately each class of these cases. The text and the tables of cases will show the clinical data on which the classification is based.

In the majority of our cases, the foreign body accident occurred while

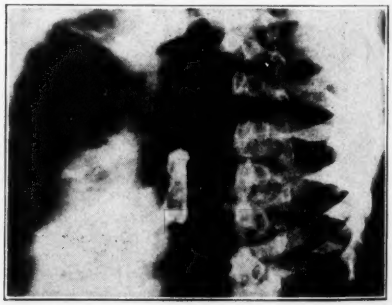

Fig. 13.—Case in a man, aged 37, showing a dental plate in the midthoracic esophagus. The patient had not consulted a dentist for fifteen years. The plate at this time fitted poorly and was lost downward during sleep.

the patient was in the dentist's chair. This does not mean that dentists have been responsible for the presence of the foreign body. Indeed, one of the most remarkable facts demonstrated by our records and reported by me, many years ago,[7] is the rarity of instances of loss of any object in the mouth by the dentist. When one considers the millions of times dentists, collectively, work with instruments and materials in the mouths of patients each year, the fact that so few foreign body cases occur is a great tribute to the skill and training of the dentist's fingers and to the conscientious carefulness of his daily work. It is interesting to note that all of the cases of inspiration of teeth during an extractive procedure, with a single exception, occurred in the chair of skilled exodontists who were in constant training, and not at the hands of the occasional operator.

Anesthesia.— No general anesthesia was being used when the root canal broaches were inspirated. Nitrous oxid was being used in almost all cases in which a tooth had been inspirated during an extraction. Ether was the anesthetic being used in the cases of a tooth inspirated during surgical work on the jaws and in the cases in which the tooth was dislodged by the mouth gag or by instrumentation during tonsillectomy. Ether was also being used in the cases in which a dental appliance was dislodged by the anesthetist, and was inspirated by the patient. The fact that nitrous oxid was being used in almost all the cases

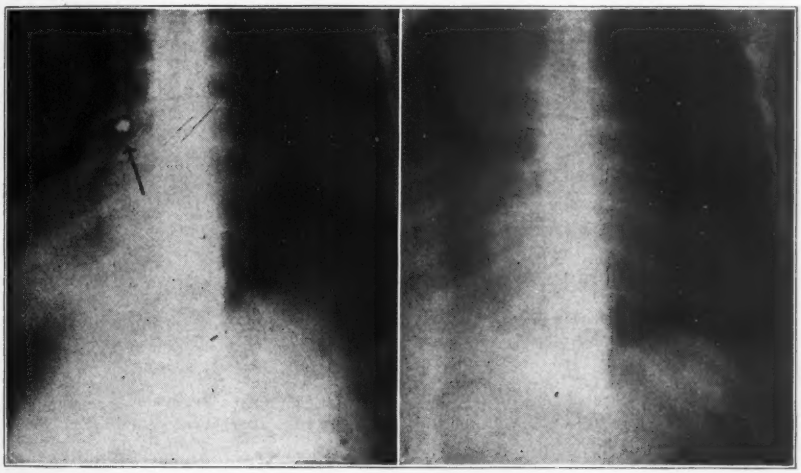

Fig. 14.—Case in a man, aged 49, showing a metallic filling in the right lower lobe bronchus with an area of drowned lung distal to the foreign body. Diagnosis of pneumonia had been made. The signs on which the diagnosis had been based entirely disappeared when the foreign body was removed bronchoscopically. The tooth filling had been lost during the extraction of a tooth under gas anesthesia, three weeks before the patient was admitted to the Clinic.

7. Footnote 5, second reference.

when teeth were inspirated into the bronchus during exodontia might be construed as due to the stertor, or to the necessity for rapid work; but we must remember that it is the most frequently used anesthetic, that inspiration of teeth, broaches, braces, etc., has occurred when other anesthetics, general and local, were being used, and, in some cases,

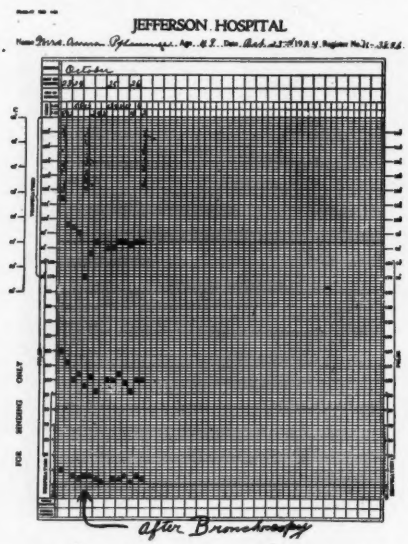

Fig. 15.—Chart showing immediate fall in temperature when drainage was restored through uncorking of the bronchus by the bronchoscopic removal of the tooth filling.

those of broaches, for instance, in which no anesthetic whatever was in use. In a number of cases, the teeth, mostly deciduous, were inspirated independently of anesthesia or any dental procedure.

Position of the Patient.—On purely theoretical grounds, the position of the patient usually used for exodontia under gas, and for much of the work in the chair, would seem to favor the dropping backward of anything loose in the mouth. On the other hand, this position was not used in the tonsillectomic and general surgical cases in which dental objects were inspirated. In one case, a deciduous tooth was inspirated when the child stumbled.

The tooth itself as a factor in etiology presents interesting data, though some points remain to be determined. A tooth so extensively carious as to crush under the forceps scattered fragments free of the forceps in a number of cases. A root was the most frequently occurring

Fig. 16.—Case in a woman, aged 26, showing a metallic filling in the left main bronchus. The patient had developed pulmonary symptoms after tooth extraction under local anesthesia. After bronchoscopic removal by Dr. Ellen J. Patterson, the pulmonary symptoms cleared up.

fragment; the crown came next. Crushing, doubtless unavoidable, was the chief cause in the seven cases of fillings. The anatomic differences in the shape of the various teeth doubtless influences security of grasp, though I know nothing of the technical phases of the matter. The accompanying table will show the teeth concerned in the respective cases in which the fragment was sufficiently large to allow recognition of its anatomic characteristics.

Loss from the Forceps.—In the exodontic cases, this was frequent; but forceps. The nine root-canal broaches were all lost from the fingers.

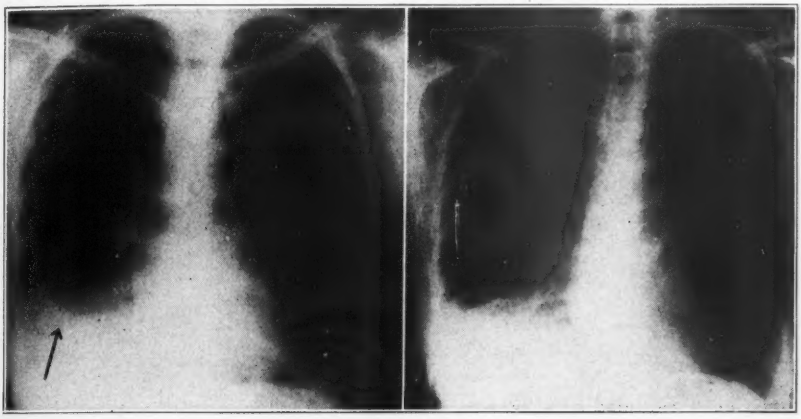

Fig. 17.—Case in a woman, aged 35 years, showing filling from a tooth in an external division of the right lower lobe bronchus. The patient had symptoms of bronchiectasis which had come on after tooth extraction under general anesthesia, two and one-half years previously. Bronchoscopic removal of the foreign body was followed by a cure of the suppurative condition of the lung.

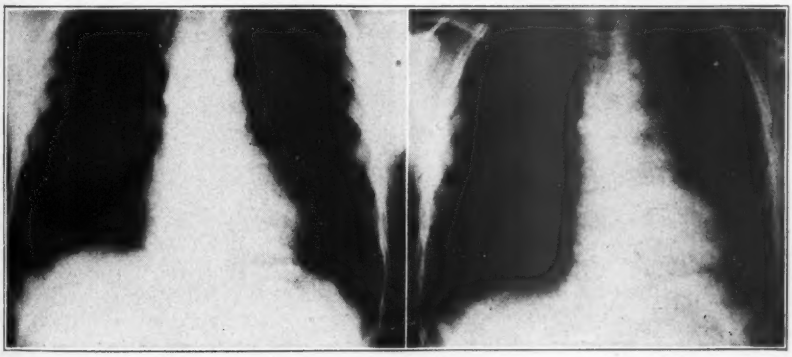

Fig. 18.—Case in a boy, aged 11 years, showing a tooth in the right main bronchus with obstructive emphysema of the right lung. After tonsillectomy, a wheeze developed, with cough and purulent expectoration. The lung cleared up entirely after bronchoscopic removal of the tooth.

it is interesting to know that, of the sixty-nine cases, in only four was there a loss of an object from the thumb

Artificial dentures were swallowed while the patient was eating, in some instances, but eating could not be said to

be the primary cause as, in every instance, the denture had become ill-fitting from alveolar changes or breakage; in other words, the etiologic factor was

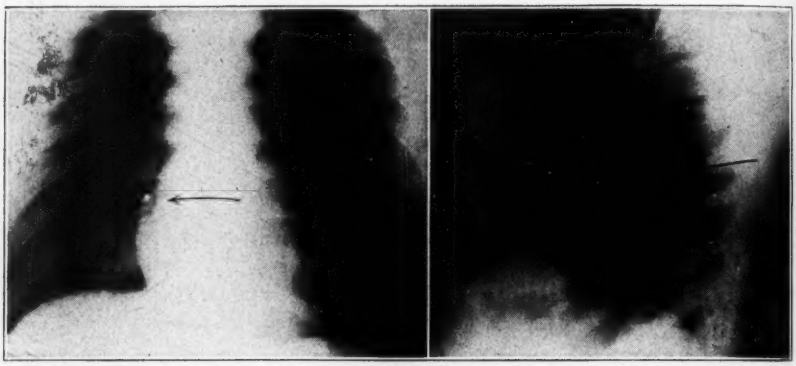

Fig. 19.—Case in a girl, aged 7 years, showing a deciduous tooth in the right lower lobe bronchus. After tonsillectomy, the patient developed a cough, purulent expectoration and irregular fever. At the end of ten days, roentgen-ray examination was made. The tooth, which had been dislodged by the mouth gag and aspirated, at the time of tonsillectomy, was removed bronchoscopically.

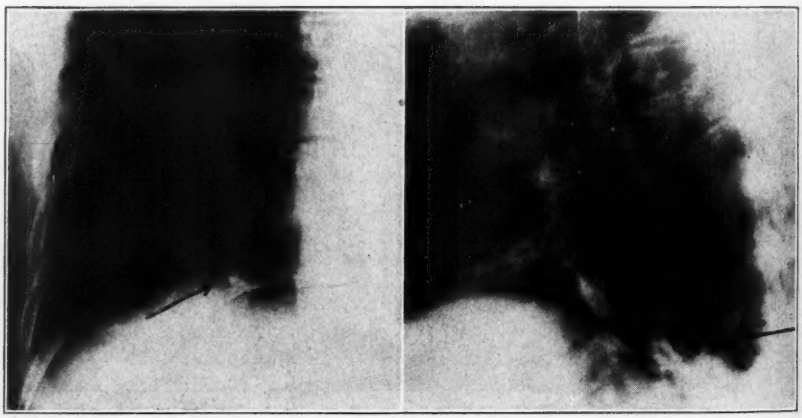

Fig. 20.—Case in a man, aged 43, showing the root of a tooth in the right lower lobe bronchus after the extraction of a number of teeth under general anesthesia. Pulmonary symptoms developed. Roentgen-ray examination was pronounced negative for evidence of any portion of tooth in lung. The patient was sent to the mountains where he improved somewhat and gained weight, but purulent expectoration and wheeze persisted. On his return home the symptoms became more severe. The original films were submitted to another roentgenologist, who found a suspicious shadow in the right lung. The tooth root was removed bronchoscopically, and the pulmonary symptoms entirely cleared up.

carelessness of the patient in neglecting to see his dentist. In other cases, the denture was a good fit, but the patient carelessly fell asleep with it in his mouth. One patient complained that he had often, during the preceding fifteen years, fallen asleep with his teeth in his mouth, and he did not see why they should have gone down his throat "at this late day." Not only had extensive alveolar changes taken place, but a portion of the plate had been broken off. It should be remembered that any form of unconsciousness is as likely to cause the loosening and swallowing of a denture as is sleep or general anesthesia. Coma, delirium, shock, alcoholic intoxication, and epileptic seizures have been causes.

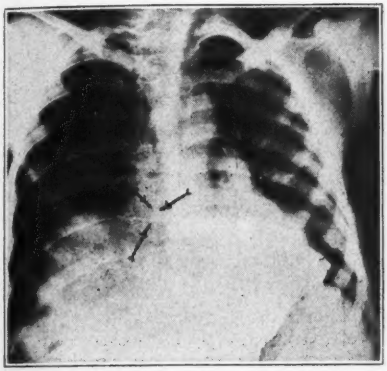

Fig. 21.—Case in a man aged 24, showing an abscess in the right middle lobe of the right lung. Dr. Borne of the Pennsylvania Hospital noted a shadow suspicious of a portion of tooth. The history stated that three months prior to the patient's admission, a number of teeth had been extracted under general anesthesia. After bronchoscopic removal of a tooth from the right lung, the condition entirely cleared up.

Root-Canal Broaches.—The fact that so many of these instruments have been inspirated into the lungs renders etiologic study important as well as interesting. As I have before stated,[8] the basic causative factor would seem to lie in the instrument itself, because we have never had a case of any other unbroken

8. Footnote 5, second and third references.

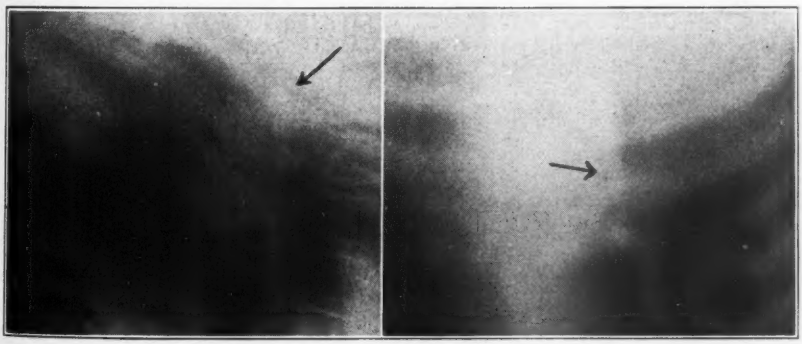

Fig. 22.—Case in a man, aged 55, showing a small portion of filling of a tooth in the right lower lobe of the bronchus. Symptoms of pulmonary suppuration had developed after extraction of a number of teeth, some of which were crushed, and all the fragments of which were not accounted for. After bronchoscopic removal of the foreign body the pulmonary suppuration was cured.

dental instrument. We have had many cases involving teeth, appliances, crowns, fillings, artificial dentures, etc., but none involving instruments. Considering the millions of hours that dentists collectively have worked in the mouths of patients, it is remarkable not only that so few foreign body accidents have occurred, but also that, of all the instruments, properly so-called, the broach should be the only kind that, to our knowledge, has reached the bronchi. Of the cases of surgeons' instruments the only cases have been parts of instruments lost downward when instruments broke or came apart. We have removed such parts as a tonsil snare wire, forceps catch, mouth-gag lamp, nasal rasp and tonsil sponge. All of the surgeon's instruments are too long for the entire instrument to be lost downward; therefore, we feel warranted in saying of the broach that the basic factor must be in the instrument itself.

A secondary factor, doubtless, is the manner of use; i. e., between the tips of two fingers, far back in the mouth. In most of the cases, the accident occurred while molar roots were being dealt with. A third factor seems to have been the jumping or other sudden movement of the patient, due to pain. In one instance, the patient told us that he had knocked the dentist's hand away, and, doubtless, this occurred in other instances.

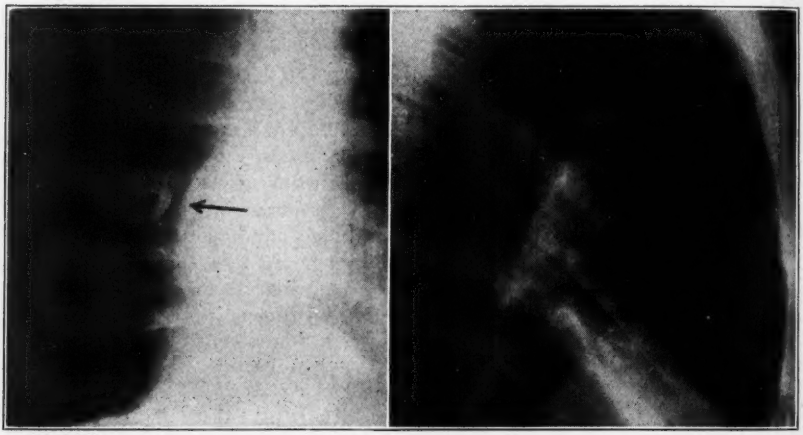

Fig. 23.—Case in a man, aged 35, who had had all of his upper teeth extracted under gas anesthesia. Bronchial symptoms developed at the end of one week. After bronchoscopic removal of the tooth, the pulmonary symptoms cleared entirely.

SYMPTOMATOLOGY AND DIAGNOSIS

Before mentioning any symptom, it seems of the utmost importance to state that symptoms may be entirely absent. When we recall the violent choking and strangling that we each and all have experienced when a crumb of bread or even a drop or two of water has "gone down the wrong way," it seems incredible that a sharp steel broach may go down into the lung and the patient have

Fig. 24.—Case in a youth, aged 18, showing a tooth crown in the left main bronchus. The tooth was crushed in the forceps during extraction, the crown of the tooth being aspirated. Removal was accomplished by peroral bronchoscopy.

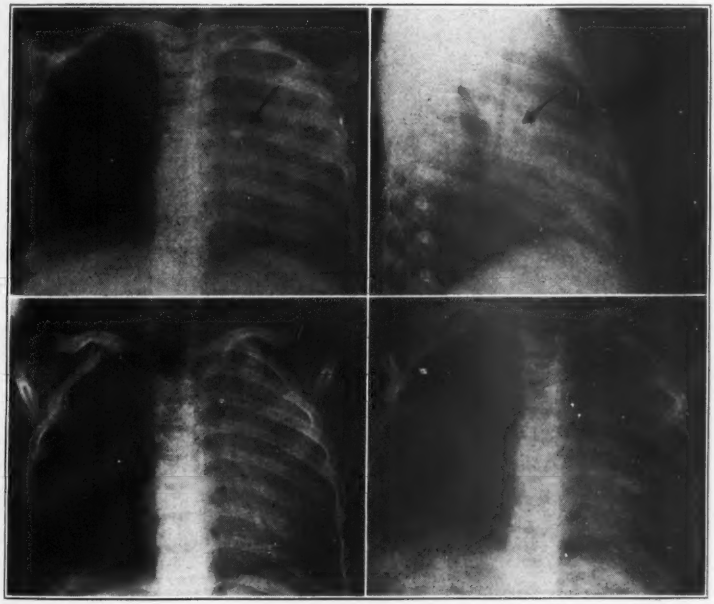

Fig. 25.—Case in a boy, aged 13 years, showing a deciduous tooth in the left main bronchus, with drowning of the left lung. During tonsillectomy under ether anesthesia, eleven teeth had been extracted. Pulmonary symptoms developed. Roentgenologic examination was made on the twelfth day. After bronchoscopic removal of the foreign body, the condition cleared up entirely.

for days not the slightest cough or subjective sensation of any kind. This symptomless interval is the rule with nonobstructive metallic objects. Teeth, on the other hand, immediately or after a very short interval, usually set up an

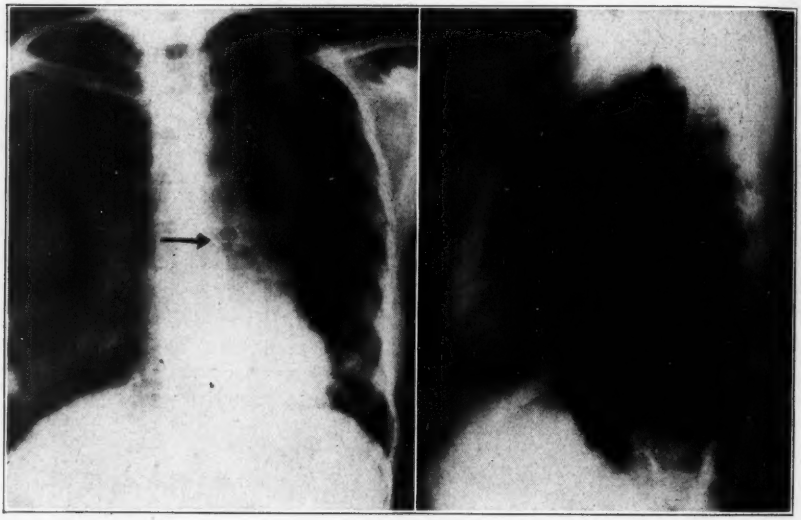

Fig. 26.—Case in a girl, aged 13 years, showing a deciduous tooth in the left main bronchus. Fever, cough, and purulent expectoration developed three days after tonsillectomy. Pulmonary symptoms continued. At the end of three weeks, a roentgen-ray examination of the chest showed the tooth in the left main bronchus. After bronchoscopic removal of the foreign body, the lung promptly cleared up.

Fig. 27.—Case in a child, aged 7 years, showing a deciduous tooth in the right lower lobe bronchus. Pulmonary symptoms developed the third day after tonsillectomy. Roentgen-ray examination on the fourteenth day showed that the lower lobe of the right lung was blocked by the foreign body. Recovery was complete after bronchoscopic removal of the tooth.

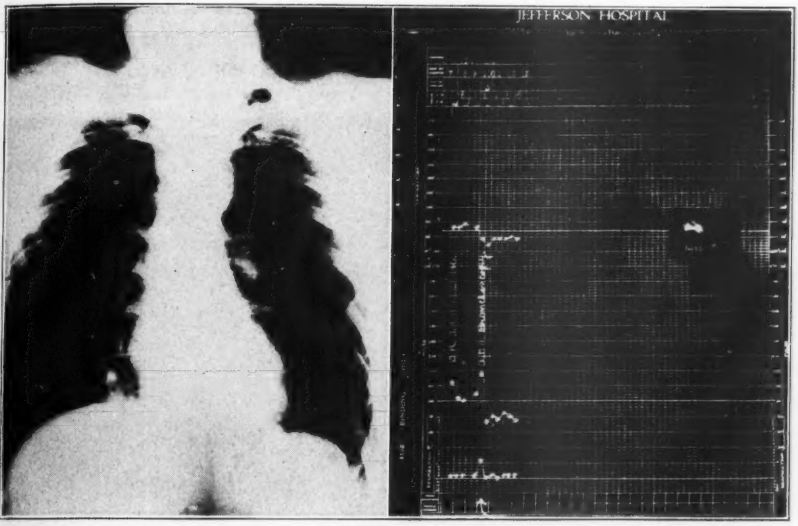

Fig. 28.—Case in a man, aged 40, showing a tooth in the right bronchus. After appendectomy under general anesthesia, at which time several teeth had been extracted, the patient developed pulmonary symptoms. After a year's illness, a roentgen-ray examination showed a tooth in the right lung. The condition cleared up entirely after bronchoscopic removal of the tooth.

irritative cough. Expectoration soon follows. The sputum may be blood-streaked, but often it is not. Later, it becomes foul. Fever, a late symptom, is usually irregular. Chilliness is rare except in advanced septic cases. The respiration is increased in cases of teeth, but normal with nonobstructive metallic objects. Obstructive foreign bodies of any kind soon result in pathologic changes in the tributary area of lung, and these give rise to the usual symptoms of lung suppuration. The asthmatoid wheeze is an important symptom in some cases. It is heard at the open mouth. Expectoration of blood, either as clots or as streaks in the sputum, is present is some instances. Diagnostically, blood-spitting is important, if it be certain that the blood as either clots or streaks comes up from

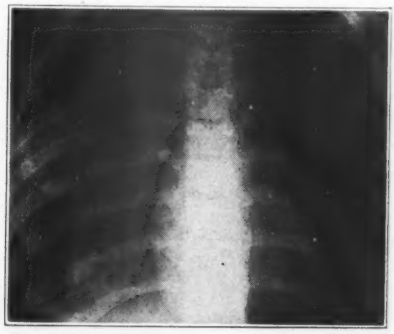

Fig. 29.—Case in a boy, aged 10 years, showing the crown of a deciduous tooth in the right stem bronchus, with a drowned lung involving the lower and middle lobes of the right lung. The patient supposedly developed pneumonia after tonsillectomy. Roentgen-ray examination at the end of ten days showed the tooth in the lung. After bronchoscopic removal, the lung rapidly cleared.

the tracheobronchial tree, and not from the gums. Absence of blood-spitting is of no significance.

Physical signs of bronchial obstruction and drowned lung, if present, are of the utmost importance. Limitation of

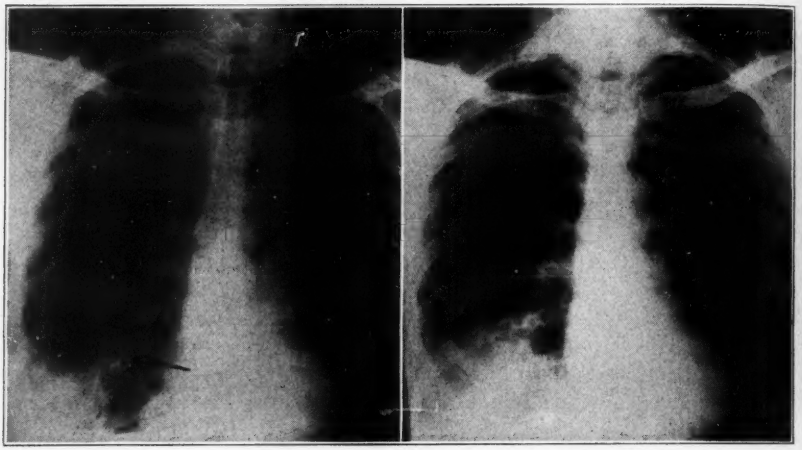

Fig. 30.—Case in a man, aged 34, showing a portion of tooth in the right lower lobe bronchus. During the removal under local anesthesia, the tooth crushed in the forceps, and this portion was aspirated. Removal was accomplished by peroral bronchoscopy.

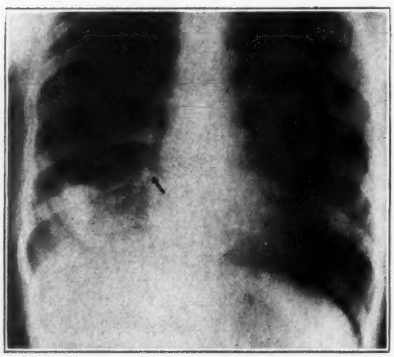

Fig. 31.—Case in a child, aged 9 years, showing a deciduous tooth in the right lower lobe bronchus. The patient had had a tonsillectomy ten days before. Pulmonary symptoms developed on the third day. After bronchoscopic removal of the foreign body, the lung cleared up in two days.

expansion on the invaded side is usually present. The almost constant occurrence of this very important sign in cases without bronchial obstruction was first discovered by Thomas McCrae in one of our cases of inspiration of a root-canal broach and has since been abundantly verified in all kinds of nonobstructive foreign bodies. As pointed out by Professor McCrae,[9] pneumonia and empyema are the chief diagnostic errors, made chiefly because of the impaired percussion note. Pneumonia, as the term is understood by internists, is so rare after inspiration of a foreign body that we may say it does not occur. An

9. McCrae, Thomas: Clinical Features of Foreign Bodies in the Air Passages, Lancet, 1: 735 (April 12), 787 (April 19), 838 (April 26) 1924.

erroneous diagnosis of "pneumonia" has led to unnecessary postponement of bronchoscopy, though, even if present, it probably would be no contraindication.

Roentgen-ray examination of the entire anatomy from the nasopharynx to the tuberosities of the ischia is essential in every case. Dr. Manges, who is to discuss this subject, will present the matter from the point of view of one who has had large experience and possesses great skill in this class of work.

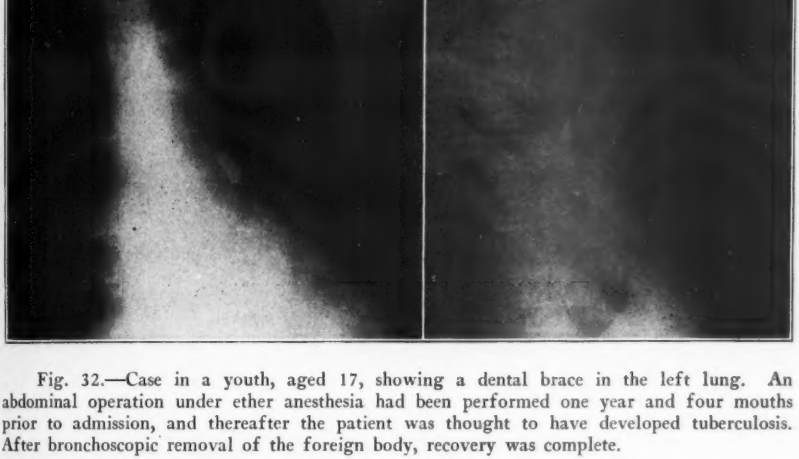

Fig. 32.—Case in a youth, aged 17, showing a dental brace in the left lung. An abdominal operation under ether anesthesia had been performed one year and four mouths prior to admission, and thereafter the patient was thought to have developed tuberculosis. After bronchoscopic removal of the foreign body, recovery was complete.

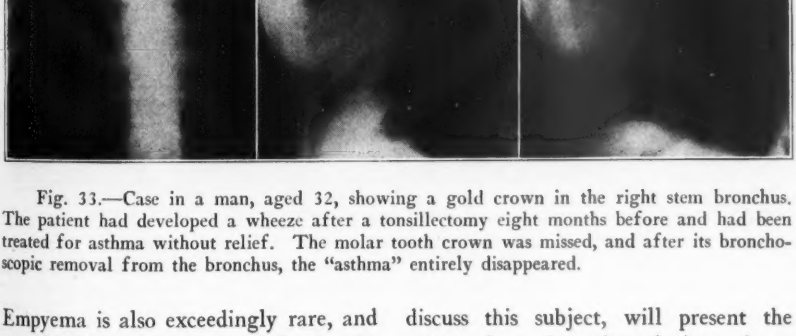

Fig. 33.—Case in a man, aged 32, showing a gold crown in the right stem bronchus. The patient had developed a wheeze after a tonsillectomy eight months before and had been treated for asthma without relief. The molar tooth crown was missed, and after its bronchoscopic removal from the bronchus, the "asthma" entirely disappeared.

Empyema is also exceedingly rare, and practically never occurs early in the case. Drowned lung is often wrongly diagnosed empyema.

In concluding the matter of symptomatology, it seems important to urge that much more important than any study of symptoms is the knowledge, or even the slightest suspicion, on the part of the dentist, that something has gone downward from the mouth. It would seem, from every point of view, that the patient should be told of the suspicion. He can be honestly assured that there

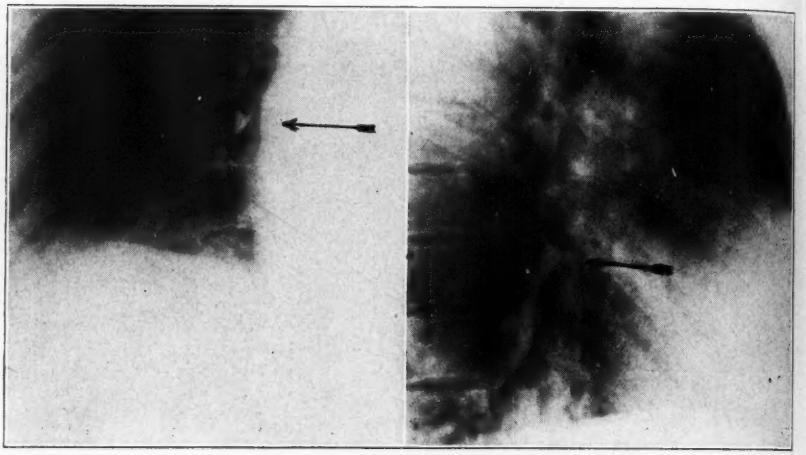

Fig. 34.—Case in a man, aged 31, showing a tooth in right lower lobe bronchus. The tooth had slipped from the grasp of the forceps during extraction and was aspirated. Removal was accomplished by peroral bronchoscopy.

Fig. 35.—Case in a man, aged 26 years, showing a gold crown in the right lower lobe. The crown slipped from the dentist's fingers while he was fitting it on the tooth. Roentgen-ray examination showed the tooth in the right lower lobe bronchus. It was promptly removed bronchoscopically and no pulmonary complications developed.

need be no cause for alarm; that if anything did go down, it will probably pass; but that it would be advisable to have a roentgen-ray examination. This is not

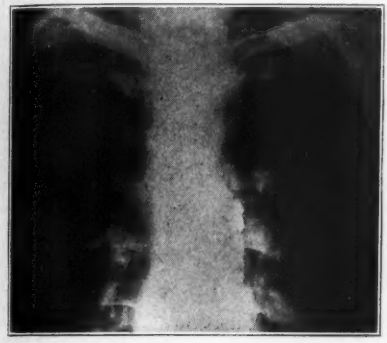

Fig. 36.—Case in a man, aged 44, showing a gold three-tooth broach in the right bronchus. It had become loosened while being fitted to the teeth and was aspirated. A loud asthmatoid wheeze developed immediately. After bronchoscopic removal of the broach, the wheeze entirely disappeared.

only just to the patient but also places the dentist at once in a position free from anxiety, annoyance and likelihood of litigation. The family physician

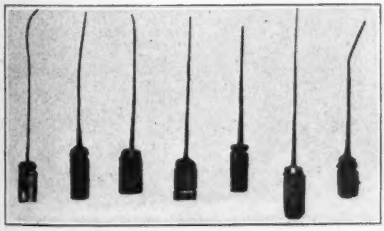

Fig. 37.—Seven different broaches removed from the lungs of seven patients by bronchoscopy through the mouth, without general anesthesia, at the bronchscopic clinic. The instruments had all been lost downward by dentists at work in the mouths of the respective patients.

should be informed of the possibility of inspiration or swallowing of a foreign body. This will add to the dentist's peace of mind.

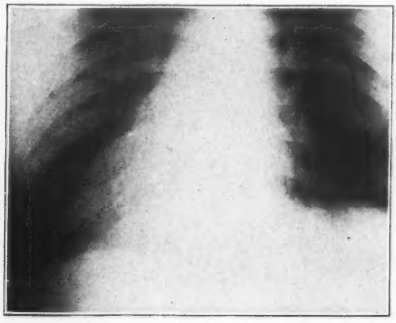

Fig. 38.—Case in a man, aged 29, showing a root canal reamer in the posterior division of the right lower lobe bronchus, below the level of the diaphragm. It slipped from the dentist's fingers while he was working on an upper molar, and was aspirated. Removal was accomplished by peroral bronchoscopy.

Fig. 39.—Case in a man, aged 40, showing a root canal broach in the left upper lobe bronchus. It had slipped from the dentist's fingers while he was working on an upper molar, and had been aspirated.

PROGNOSIS

Teeth and other dental objects have been coughed up; but as far as we have been able to determine, this has occurred in only about 3 per cent of the cases in which the foreign body was known to have been actually in the bronchi. If not expelled or removed, serious illness and ultimate death may be expected. Therefore, full justice will be done the patient if he is told that, while spontaneous expulsion is a possibility, the

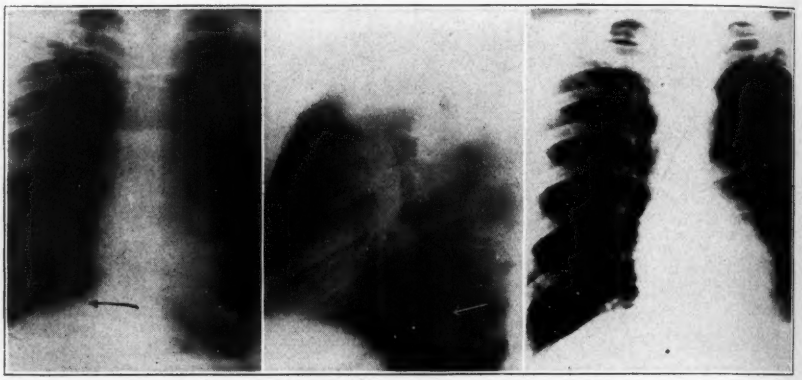

Fig. 40.—Case in a girl, aged 18 years, showing a dental root canal reamer in the posterior division of the right lower lobe bronchus. It was dropped from the fingers of the dentist, while he was working on a lower molar, and was aspirated into the lung.

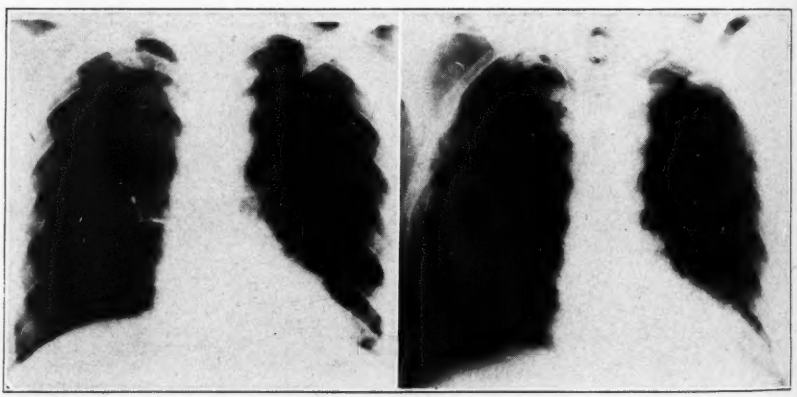

Fig. 41.—Case in a man, aged 35, showing a root canal broach in the middle lobe of the right lung. It had been inspirated when it slipped from the fingers of the dentist, who was working in a molar root canal. It was removed through the mouth by bronchoscopy, without general anesthesia.

chances are only about 3 per cent and the risk incurred by waiting is too serious to be taken. On the other hand, peroral bronchoscopic methods of removal, as now perfected, are successful in practically all cases, and complete recovery of the patient follows in all of the recent cases. Of the prolonged sojourn cases, about 97 per cent of the patients recover. A very important factor in prognosis is the earliness with which the diagnosis is made. The prognosis in cases of artificial dentures in the esophagus is good if dealt with by peroral endoscopic methods. These methods are suitable for all cases, however large the denture may be.[5] Full upper as well as lower dentures have been esophagoscopically removed.[10] The prognosis of removal by external surgery is about 15 per cent mortality in cervical esophagotomy, 97 per cent in transthoracic esophagotomy.

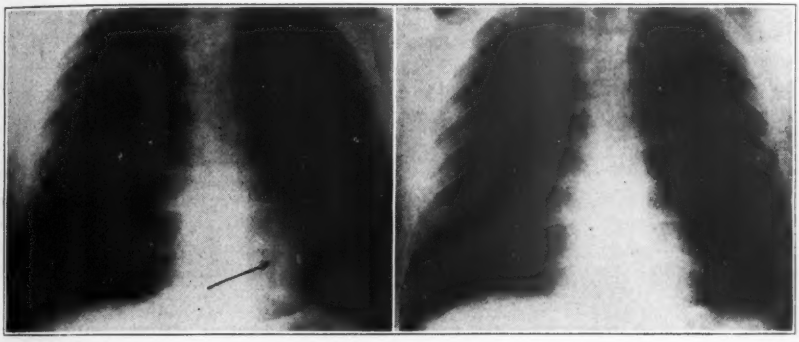

Fig. 42.—Case in a man, aged 20, showing a root canal reamer in the left lower lobe bronchus. It was aspirated after slipping from the dentist's fingers, while he was working on an upper molar. Removal was accomplished by peroral bronchoscopy.

PROPHYLAXIS

Not being a dentist, I am not qualified for full and proper presentation of the subject of prophylaxis; but foreign body accidents are purely mechanical and therefore means for their prevention can be devised. The dentist who has had one foreign body accident will never have another, because of the ever-

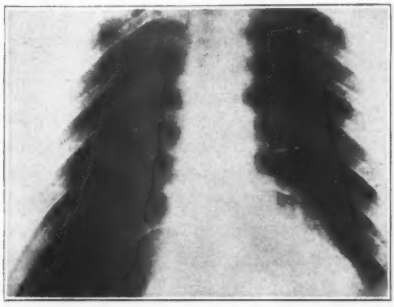

Fig. 43.—Case in a man, aged 30, showing a dental root canal reamer in the left upper lobe bronchus. It was lost downward during dental operation. It had ben aspirated around the corner into the left upper lobe bronchus. Removal was accomplished by peroral bronchoscopy.

10. McReynolds, G. S.: Full Upper Tooth Plate Removed from the Esophagus, J.A.M.A., 87: 407 (Aug. 7) 1926.

present stimulation to utmost precaution. The dentist who has not had an accident may profit by the experience of a dentist who has had such a misfortune, and be equally cautious.

Root-Canal Broaches.—I am informed that the rubber dam will prevent these instruments escaping downward. The interesting fact remains that patients continue to come in with broaches in the lungs. The most recent one came in a few months ago.

Exodontia.—Not being a dentist, I am not qualified to consider this subject.

Fig. 44.—Case in a man, aged 65, showing a root canal reamer in an upper division of the left upper lobe bronchus. The instrument had been lost from the fingers of the dentist, and aspirated. Removal was accomplished by peroral bronchoscopy.

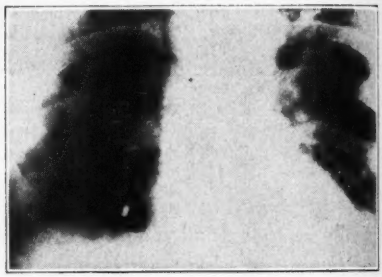

Fig. 45.—Case in a physician, aged 39, showing a root canal reamer in a small posterior branch of the right inferior lobe bronchus. The instrument slipped from the dentist's fingers while he was working on an upper molar. Removal was accomplished by peroral bronchoscopy.

I have only one suggestion to make, and doubtless this is superfluous. It would seem a wise precaution to match fragments and count teeth as the nurse counts the sponges for the abdominal surgeon. It is remarkable to note how often, in cases in which a tooth has been found to be the cause of the patient's lung-suppuration, we have found that all teeth were thought to have been accounted for. In most instances, the foreign body was not an entire tooth but a fragment.

Careful matching of fragments to see if any are missing takes time as well as anatomic knowledge; but it would seem advisable to have some competent person do this in every exodontic case.

Removal of Loose Deciduous Teeth.—On the general question of the influence on the permanent teeth of the extraction of deciduous teeth, I have nothing to say; but we have had ample clinical evidence that very loose deciduous teeth are a menace. There is wisdom in the rule of George H. Fetterolf[11] to remove loose deciduous teeth before tonsillectomy or any other procedure to be done under general anesthesia.

Removal of Orthodontic Appliances Before General Anesthesia.—Of course every anesthetist removes artificial dentures. With fixed and semi-fixed appliances, the question is one that should be taken up with the dentist in the particular case. In case of opera-

11. Fetterolf, George: Personal communication.

tions about the mouth, the use of a mouth gag is imperative, and most operators would feel handicapped in using any gag other than that to which they are accustomed. This one may be the mouth and jaws, a gag is rarely necessary.

Next in importance to prevention of the accident is prevention of serious consequences to the patient. Almost with-

DENTAL OBJECTS REMOVED BY BRONCHOSCOPY

52 *Dental Objects* 5.2%

Classification	Quantity	Per Cent on 1,000 Foreign Bodies	Per Cent on Total Dental Foreign Bodies	LOCATION									
				Lungs				Trachea		Esophagus		Pharynx	
				Right		Left							
				No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent	No.	Per Cent
Artificial dentures Plates & Bridges	18	1.8	34.6	1	5.5	3	17			13	72	1	5.5
Dental reamers	5	.5	9.6	4	80	1	20						
Gold crowns	3	.3	5.8	3	100								
Teeth	16	1.6	30.8	14	87.5	2	12.5						
Tooth fillings	5	.5	9.6	3	60	2	40						
Miscellaneous	5	.5	9.6	1	20	1	20	3	60				

Total number and general percentage in each location	Location	Lungs				Trachea		Esophagus		Pharynx	
		Right		Left							
	Number	26		9		3		13		1	
	Percentage		50		17.3		5.7		25		2

of a kind very hard on teeth and dental appliances. In case of general anesthesia for operations on regions other than oral, the use of a gag may become necessary, though a skilful anesthetist will usually be able to avoid this. The very careful and sparing use of the gag should be thoroughly drilled into every anesthetist. Except for operations about

out exception, a foreign body entering the bronchi by way of the mouth and removed within a few days by peroral bronchoscopic methods is harmless. The normal defensive mechanism of the lung presents a barrier, structural or physiologic, against pulmonary septic invasion by the endobronchial route. Whatever infective materials may have

been carried down by the foreign body are held in check by the defensive mechanism. If removal is neglected suppurative processes gradually develop and the patient becomes ill. Humanity aside, taking the matter from an every-day practical point of view, the patient from whom a foreign body has been removed within a few days by peroral bronchoscopy has a hard time trying to show that he has suffered much or that he is any the worse physically. On the other hand, the patient with lung suppuration due to neglect of early diagnosis and removal has a good case with which to elicit the sympathy of the jury.

Prophylactic Instructions to the Patient.—It is presumptuous for me even to suggest what the dentist should tell a patient who has not actually aspirated a foreign body; but our clinical experience as bronchoscopists emboldens me to mention a few things that are probably already familiar to the dentist. I venture to emphasize the advisability of impressing on patients newly fitted with dentures the following points:

1. The denture always should be removed before sleeping or even dozing.
2. In case of breakage or damage however slight, no attempt should be made to wear the denture, until it is properly repaired.
3. There is risk of a foreign body accident in wearing a denture that has become ill-fitting by the inevitable anatomic changes of form.

Teaching Prophylaxis. — Unconsciousness from intoxication, shock, delirium, coma, epilepsy or any other condition involves just as much risk of the loosening and swallowing of a denture or loose appliance as natural sleep. Hence, all medical students, interns and nurses should be taught the necessity for immediate oral inspection when these conditions are present or impending.

The power and the opportunity of the dentist to teach the laity in general and mothers in particular how to avoid foreign body accidents, most of which are preventable, makes me regret that space limits prevent consideration of this subject here. It is hoped that dentists will read the article on this subject, published in *Hygeia.*[12]

TREATMENT

What is to be done in case a dentist suspects a foreign body accident has happened to the patient in the chair?

In answer to this question, the following summary of my own writing on this subject will serve as well as if rewritten.[13]

When a root-canal broach, a tooth, appliance, cap-filling or any other object is missed, the first thing to do is to order a roentgen-ray examination of the air and food passages, whether the object in question is opaque to the ray or not. We realize the feeling that one does not wish needlessly to alarm the patient; but it is precisely this situation that may make the dentist liable. No one is legally liable for an unavoidable accident. Negligence always gives ground for litigation. If the dentist suspects that he has lost an instrument or other object down in a patient's anatomy and fails to take proper steps to safeguard the patient's best interests, he becomes liable for negligence. His finer feelings as to saving his patient possibly unnecessary anxiety will be misconstrued and held up mercilessly to ridicule by the

12. Jackson, Chevalier: What Does Your Baby Put in His Mouth? Hygeia, December, 1923.

13. Footnote 5, third reference.

patient's attorney. The first step, then, is to tell the patient of the suspected possibility and advise roentgen-ray examination. If the patient neglects this advice the responsibility is his; but the burden of proof that such advice was given will be on the dentist.

The roentgen ray examination should include the entire anatomy from the roof of the nasal chambers to the tuberosities of the ischia. If the foreign body is revealed in the stomach or intestines, the chances are good that it will pass; but this should not be taken as a certainty. The stools should be watched and a daily observation should be made with the ray. If the foreign body is not visible in the fluoroscope, good films should be made. During this period, no change in diet is advisable and no cathartics should be given.

The responsibility for all this, however, had best be borne by a physician. If the foreign body should lodge and remain in one location in the intestines for as long as a week, the advisability of abdominal surgery should be considered because of the possibility of its ulcerating through the bowel; but as long as the foreign body keeps moving onward, the patient is safe.

If the ray should reveal it in the esophagus, the foreign body can be quickly and safely removed by esophagoscopy without anesthesia, general or local. No external operation is worthy of a moment's consideration.

If the ray should show the foreign body in the tracheobronchial tree, it can be quickly and safely removed through the mouth by bronchoscopy, under local anesthesia, or without even local anesthesia if necessary. Here, also no other procedure is worthy of moment's consideration. No after-treatment has been necessary in any case.

CONCLUSIONS

1. Cough after any operation, anywhere, with or without anesthesia, general or local, is always a matter for an investigation, as all surgeons know. Dentists are fortunate in having fewer pulmonary complications than other practitioners, and hence may be less alert to these possibilities. When a patient has a cough, however slight, following a dental procedure, it seems advisable for the welfare of the patient as well as for the interests of the dentist concerned to determine whether the cough is etiologically connected with the procedure or is purely intercurrent. Most often, the latter will be the case; but neglect of investigation on this assumption would expose the dentist to liability, morally and financially.

2. No one, in principle, is liable for the results of an accident occurring in spite of care and safeguard; but neglect of investigation on the occurrence of suspicious symptoms involves liability as well as neglect of technical precautions against accident.

3. After every multiple tooth-extraction, the teeth should be counted as the nurse counts the sponges of the abdominal surgeon. Fragments of teeth and fillings should be matched for missing fragments. Doubtless, this is done by most exodontists, but in some of our cases, a missing portion of a tooth must have been overlooked in the accounting. If any tooth, filling or fragment is missing, roentgen ray examination and watching of the stools should be advised.

4. Roentgen ray examination should include all the patient's anatomy between the levels of the nasopharynx and the tuberosities of the ischia.

5. Technical criticisms on the root-canal broach and the manner of its use

have come to us; but the clinical fact remains that, twelve years after we published our first case, we are still taking these broaches out of the bronchi.

6. It is unwise to conclude from an absence of symptoms that no foreign body has reached the tracheobronchial tree; even cough may be entirely absent for a time.

DISCUSSION

Willis F. Manges, Philadelphia, Pa.: Of all the bronchial foreign bodies that come to the attention of Dr. Jackson's clinic, the root of a tooth or fragment of a tooth is the one that most constantly produces serious lung infection in a relatively short time. There have been a sufficient number of unsuspected cases that have come to final bronschoscopic proof to lead one to infer that there are other unsuspected cases that are not discovered. A large part of the bronschoscopic work in Dr. Jackson's clinic is done for diagnostic or therapeutic reasons other than the removal of foreign bodies. There are, in his collection, a number of foreign bodies that have been found and removed simply because he has shown that bronchoscopy offers the best results in the treatment of lung infection, regardless of the cause, especially in the lower lobe areas, where most foreign bodies are found, and, further, because it has been repeatedly demonstrated and is becoming widely known that bronchoscopy in skilful hands is the most important of all procedures in the differential diagnosis of tracheobronchial disease. The first point to mention in the discussion of the roentgen-ray diagnosis of dental foreign bodies is that we never make a negative diagnosis of anything except metallic objects, such as instruments, filling materials, appliances or dentures of considerable size. In more than one instance, patients have come to Dr. Jackson with a suggestive history but with a negative roentgen-ray diagnosis. In such instances, we have taken note of faint shadows and then have made a special effort to produce roentgenograms of such areas that show the utmost contrast and detail in the shadows, and have thus made diagnosis positive when it had been negative or doubtful. In other instances, we have obtained recognizable shadows after Dr. Jackson has removed the pus from the region of the foreign body by means of bronchoscopic aspiration. In one case, the surrounding diseased lung tissue and exudate prevented a recognizable shadow of a root of tooth but a small piece of root canal filling did cast a shadow that was visible and that led to the removal of a root of a tooth. I know of one instance in which a portion of a crown of a tooth did cast a perfectly definite shadow but was thought by the roentgenologist to be only one of a number of partly calcified glands that were present on both sides at the roots of the lung. Because of this negative roentgen-ray report, bronchoscopy was deferred, and later the patient coughed up the foreign body and sent it on by mail. The shape and size corresponded exactly to the shadow in the roentgenogram. So there are many reasons why one should not make a negative diagnosis. Then, too, it must be evident that small fragments of tooth or alveolar process might easily escape roentgen-ray diagnosis because of the density and inconstancy of other structures in the region of the tracheobronchial tree. There have been two or more patients in whom more than one fragment of tooth has been present in the same bronchus. I should like to emphasize Dr. Jackson's advice that the entire area of the air and food passages be included in the roentgen ray study, and, especially, the alveolar process when fragments of root are not accounted for. Let me assure you that the best time to make a roentgen-ray search for a dental foreign body in the air or food passages is immediately after the possibility of such an accident is apparent or suspected. The fluoroscope should never be the only method of roentgen-ray study, but one may get valuable information by means of it. Roentgenograms of the best quality should be made anteroposteriorly so as to be used stereoscopically, and, in addition, lateral views are important, especially to complete accurate localization. Suggestive but not positive shadows should be investigated by roentgenograms of a small area made through a cone and with the aid of the Potter-Bucky diaphragm, and, of course, with the lungs distended with air and during suspension of respiration. A reexamination on subsequent days is always recommended when the history is suggestive or the symptoms persist. The happiest thought of the whole situation is that all of the patients suffer little inconvenience and no illness when the diagnosis

and localization are made and the foreign body is removed early by means of bronchoscopy. The unhappy thought is that, if it is not removed, serious ill health and premature death must follow. In the esophagus, dental foreign bodies offer much less difficulty in roentgen-ray diagnosis, for in all cases when the foreign body is large enough to lodge, it is also dense enough to cast a distinguishable shadow or large enough to obstruct the passage of opaque material swallowed during a fluoroscopic observation. One is amazed, at times, because of the size of a foreign body that a patient may partially swallow. As a rule, the diagnosis is made clinically. However, in one case that I studied some years ago, a fairly large dental plate had been in the esophagus seventeen years. In another more recent case, the patient reported the loss of a false-tooth plate and went hurriedly to a doctor. The doctor thought he could feel it in the neck, and he sent the patient to a roentgenologist. The latter reported that the false-tooth plate was in the esophagus at the level of the suprasternal notch, after making a single anteroposterior roentgenogram. The patient was then sent to Dr. Jackson, who sent her to me for confirmation of the diagnosis. I found that she had a fairly large calcified thyroid gland, which felt hard and which cast a dense roentgenographic shadow, but which had nothing to do with the esophagus. Her swallowing function was normal. In short, the whole subject of the roentgen-ray diagnosis of foreign bodies in the air and food passages resolves itself into a matter of the utmost care in the technic of the examination, and then skilful, but, particularly, thoughtful, interpretation.

Albert L. Midgley, Providence, R. I.: Dr. Jackson's treatise calls sharply to our attention possible accidents, and their consequences, which may occur at any time in the routine of the general practice of anesthesia, dentistry and the specialties of that art and science also. While some of these accidents may be unavoidable, many of them can be prevented by following precautionary procedures at all times and having in mind always that dental operations properly performed require time and care. While we should admit that speed is one of the elements essential to the development of skill in surgical procedures, it has a negative or at best a doubtful value unless it is always accompanied by safety, accuracy and sustained effort. As all of this implies care and forethought, the watchword of the skilled dentist should be safety first, last and all the time. In this era of hustle, there is a natural tendency in the busy practitioner's activities "to speed up." Therefore, the presentation of Dr. Jackson is timely and impels us to pause and to reflect. In effect, it awakens us to our responsibilities, warns us to recognize our limitations and urges us, above all, to make haste slowly and to proceed carefully before, during and after operations. How may we proceed thus, and so avoid the accidents and embarrassments alluded to? 1. By using judgment in the selection of cases and of the most effective operating technic. 2. By using care and judgment in the examination and preparation of instruments (this means not only attention in their selection and testing but also study and thought as to their relationship to possible accident, to sequence in procedure and special regard to defects or weaknesses in the instruments and faulty application of them through misdirected force and other unaccepted forms of instrumentation). 3. By following with care only accepted procedures in technic and treatment, always mindful of possible failures and depressing results, in other words, studying and acting before, during and after the operating with but one goal before us. In this relation, it is well to remember that our obligation begins with the preliminary examination, but does not end even when the operation is completed. Commenting briefly on some of the causes of these accidents and the operative deficiencies related thereto which should reduce the number of such accidents, I submit the following: 1. Failure to bear in mind at all times that all instruments and operating accessories should be under a mind-controlled hand before the operation, accounted for while it progresses and checked after it has been completed. 2. Failure to take into account the added hazards with the patient unconscious and the reflexes abolished under general anesthesia. 3. Failure to close the pharyngeal orifice with gauze before attempting to extract teeth or to perform any other operation in the oral cavity under a general anesthetic and often under local anesthesia as well. 4. Failure to have adequate attachment to a modern mouth gag plug in general anesthesia. 5. Failure to use sponges of sufficient length so that a free end will still be outside the

oral orifice in case they should be inspired or swallowed. Under general anesthesia and often under local, the use of pledgets of cotton or small gauze sponges is never warranted and has no place in oral surgical routine. If you persist in following the unskilled practice alluded to, protect your patients and yourself at least to a minor degree by making suitable attachments to the cotton or gauze with ligatures; count and check them before and after operating, and have them all accounted for during the operation. The system of checking applies also to the long sponges. 6. Failure to use the rubber dam in root-canal therapy and technic and, in those cases in which it is impossible to use the rubber dam, neglecting to have a suitable attachment to the broach or reamer so that it may be readily removed in case it is inspired or swallowed. Here, it is well to record the rôle of the rubber dam in relation to accidents in all forms of operative dentistry and in many types of oral surgery also. 7. Failure to remove calcific deposits; loose or insecure fillings; teeth loosened from alveolar absorption, either from physiologic or pathologic causes; frail walls of easily fractured teeth; loose dentures; removable bridges and other prosthetic appliances; maxillary splints; orthodontic appliances and their attachments, before administering any local or general anesthetic. In a word, we should operate in the oral cavity at all times in such a manner that force does not run ahead of a hand uncontrolled by the mind. 8. Failure to keep the field of operation free from blood, and indulgence in other questionable operative procedures with the eye, ear, hand and mind not working in unison. 9. Using unsuitable, defective or antiquated instruments. 10. Failure to use impression materials properly, especially the various types of calcium sulphate. 11. Inviting an unnecessary hazard by using poorly constructed maxillary splints and orthodontic appliances with their accessories insecurely attached; which offers a constant menace to the patient not under immediate control, especially during sleep. Henry S. Pritchett, in a recently published article, stated that "While the primary object of both medicine and dentistry is to serve the cause of public health, there has been little cooperation between the associations of physicians and dentists or between individuals of the two professions. The public has a right to expect that intelligent cooperation shall unite these two bodies of health-workers in a service whose responsibilities they share in common." The work of Dr. Jackson and his colleagues is one of the few exceptions to this statement. Contributions such as his illumine the way and tend to promote effective accord between dentists and physicians, which must result in a higher quality of health service. These men are pioneers, blazing the way in an important medicodental relationship, and we cordially welcome them. In the situations under discussion, both the welfare of the patient and the reputation of the dentist are involved, as they should be in all health-service activities. With no disrespect to the conscientious dentist, is not the embarrassing position in which the dentist finds himself because of these accidents and their consequences largely responsible for this lively interest? Is not the fact, also, that the causes of these disturbances are easily understood, since they are mechanical in nature, of material form and easily seen, directly related to this interest? Let us be equally alert to the influences of those unseen yet ever present microscopic structures, and proceed in such a manner in our operations that bacteria are not transmitted to our patients through neglect, oversight or ignorance. Let us not follow the sophistry that because the saliva has certain bactericidal properties, the addition of micro-organisms to those already in the dental and oral tissues should cause the patient no discomfort or the operator no concern, but rather follow rigidly at all times the principles of surgical asepsis in our technic. The biologic phases of dentistry's procedures have often been neglected or lost sight of, while the mechanical and esthetic phases have been widely and ingeniously developed. So the message I receive from Dr. Jackson is that, outside of care and caution, we should direct our efforts with equal interest and attention to the discovery and removal of those hidden and invisible organisms which lie in the teeth and tissues of the oral cavity and which are not without casual relations to serious disturbances in other parts of the body as well as in the respiratory tract. In substance, his message is a plea for better health-service through dentistry by effective development of the medicodental relationship. May it be heeded!

PRINCIPLES OF BIOLOGIC THERAPY AND SUGGESTED MEASURES FOR INCREASING THE SPAN OF HUMAN LIFE IN THE ADULT*

By J. P. BUCKLEY, Ph.G., D.D.S., F.A.C.D., Hollywood, California

THE statement is frequently made that within the past one or two decades the span of life has been markedly increased; that the average expectancy of life today is about 55 years. This has been brought about largely by wiping out the scourges and lessening the number of deaths from infectious diseases. Preventive medicine, with its serums and vaccines, has practically banished the ills of childhood. While it is true that fewer persons are dying today between infancy and the age of 30, the number of deaths between 30 and 60 are increasing alarmingly. It is also true that physical defects, mental instability and criminalism are rapidly increasing. With these facts in mind, it is well that we as a profession, working along the line of the health service program, should stop for a moment to consider the causes of these results.

The ills of childhood and many of the infectious diseases have been practically eliminated because of the great advance in and intelligent use of biologic therapy. Since many of the infectious diseases are known to have a direct relation to diseased mouth and throat conditions (teeth and tonsils), it is important that the student and practitioner of dentistry not only understand the principles upon which biologic therapy is based, but also know the indications and uses of the products from biologic laboratories.

In this connection, it is well to remember that bacteria are abundant in the environment of man and animals. Parasitic bacteria live habitually on the surface of the body or on mucous membranes without producing noticeable effects. The distribution of certain species in definite localities is often so nearly constant as to be regarded as a normal condition. The mouth is the most important portal of entry for the great majority of bacteria, both pathogenic and nonpathogenic. The influenza bacillus, diphtheria bacillus, pneumococcus, and even the tubercle bacillus may occasionally develop in the nose and throat of healthy individuals. Certain cocci and spirilla are always present in the mouth and pharynx. Hartzell claims that streptococci may be found in the alimentary canal from the mouth to the anus. These significant facts are mentioned that we, as dentists, may get definitely fixed in our minds that the *presence of germs* and an *infection* are not synonymous. In an infectious

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disease, the invading and exciting germ gains admission to the body and tissues in various ways: through the air into the respiratory passages (mouth, nose, throat and lungs); through food and water into the digestive tract (stomach and intestines); through cuts and abrasions of the skin and mucous membranes (inflamed and bleeding gums); through the canals of pulpless teeth, and through direct injection into the blood stream.

The significance of the presence of bacteria in any organ or tissue of the body must ever depend on whether or not a diseased condition or infection exists. An infection is the successful invasion of a tissue by microparasites, with cellular change and inflammatory reaction. Organisms may find entrance into any organ or tissue of the body, but unless they grow, multiply and produce some deleterious action on the host, their presence is without any special significance. The lack of this knowledge among dentists has resulted in the ruthless extraction of pulpless teeth in the past by those who have either misunderstood or have been misled by writers who thoughtlessly, but perhaps intentionally, magnified the significance of the mere presence of bacteria in the organs and tissues of the body.

When these bacteria have successfully invaded the tissues, where they find the proper food, moisture and temperature necessary to their growth, they multiply and proliferate rapidly; and during this growth, they produce substances known as toxins, which are poisons to the tissues of the body. Sometimes, these poisons remain largely within the cell body of the bacteria and are given off at the death of the germ. Such poisons are called intracellular toxins. An example is *Staphylococcus pyogenes-aureus*, the germ that causes boils. In other instances, the poisons are excreted by the bacteria into the tissues or blood stream and may be thus carried to various parts of the body, attacking those parts that are subnormal and have the least resistance. Poisons of this kind are called extracellular toxins. Examples of such germs are *Bacillus diphtheriae and bacillus tetani*, which cause, respectively, diphtheria and tetanus (lockjaw). *Streptococcus viridans* also belongs to this class of germs, and is of special interest to dentists for the reason that the poisons are elaborated in pyorrheal pockets about the teeth and in periodontomas and dento-alveolar abscesses. The poisons, being of the extracellular variety, are continually formed and constantly charging the blood stream as long as infection is present in these areas. Thus may follow diseases of the joints (arthritis), heart (endocarditis), kidneys (nephritis), etc. It will be observed then how absolutely essential it is for the dentist to eradicate all infections about the teeth, but he should remember that the mere presence of germs does not in itself mean an infection, nor is it necessary to extract teeth in all cases in order to rid the area of infection, even though the teeth are pulpless.

Nature is constantly on the alert to protect the body against the invasion of these germs and their poisons. Stimulated by the bacterial toxins, the body tissues react, calling forth additional cellular activity, and produce substances known as antitoxins and antibodies. The antitoxins are chemical substances that destroy the poisonous nature of the toxins. The antibodies are substances that antagonize the bacteria

themselves, actually killing and destroying them, or preventing their growth and proliferation. Thus, when infection has taken place, there is an incessant struggle against the invading organisms by the tissue cells in their effort to rid the body of the disease germs and to neutralize their toxic effects.

The manufacture and use of biologic products are based upon these principles; and, before considering the subject further, it is well that we fully understand what is meant by the term immunity. This is recognized as the ability or power that enables certain individuals to resist disease. There are two kinds of immunity: *natural* and *acquired*. Natural immunity is that which exists in a normal, healthy animal or human being. In this case, the tissues of such bodies contain or produce substances that are antagonistic to the pathogenic germs. Hence, these bacteria cannot grow in the body and no disease results. Certain persons appear to have a definite immunity to scarlet fever and diphtheria, although they have never had the disease; others repeatedly pass through epidemics of various kinds, such as measles, pertussis (whooping cough), etc., without becoming infected. Acquired immunity is the resistance to a disease that exists either after an attack or subattack of that disease, or after inoculation with some specific culture, vaccine, antitoxin or serum. An example of the first is the condition of a person who has had smallpox, or the immunity that comes in later years of youth and adult life to diphtheria; an example of the second is the condition of a person who has been vaccinated with the smallpox virus or has had an antidiphtheritic serum injected—both are immune to smallpox and diphtheria, and the immunity has been acquired. There are two kinds of acquired immunity: *active* and *passive*. Active immunity is that which is developed by the individual himself, because he has had the disease or because the immunity to it has been artificially produced. This latter is known as "vaccination." Passive immunity is a form of immunity that depends on defensive factors not originating in the person or animal protected, but is passively acquired by the injection of a serum from another that has acquired an active immunity to the disease or infection in question.

BIOLOGIC PRODUCTS

This brings us to a discussion of biologic products, which may be divided into at least three classes: antitoxins, serums and vaccines.

Antitoxins.—These are among the simplest and most useful of the antibodies. As the name implies, they antagonize toxins. Though toxins may be excreted by plants other than bacteria, and by some animals, e.g., in snake venoms, the typical toxins are the soluble poisons thrown off by diphtheria and tetanus bacilli.

Diphtheria and tetanus are dangerous diseases almost entirely because of the action of these toxins and, conversely, their prevention and cure, when the organisms have once gained entrance to the body, depend on the work of the particular antitoxin. Though the presence of the toxin stimulates the body to produce antitoxin, this active immunity may not be enough to save life; and, at any rate, assistance by the injection of antitoxin, ready made in the blood stream of another animal, hastens the cure and may prevent the disease. When the disease is developing, the

body does not produce antibodies fast enough to combat the deadly germs; hence, the need of calling for help from the field of medicine.

The antitoxins of both diphtheria and tetanus are official, and both are obtained from the coagulated blood of the horse, or other large domestic animal that has been properly immunized against the toxin produced by the germ causing the disease. Diphtheria antitoxin is measured in units. A unit is that amount of antitoxin which will save the life of a guinea-pig if injected together with a definite dose of toxin, called the L+ dose. Normal guinea-pigs of 250 gm. weight are used for the tests, and neither the pigs nor their mother should have been previously used in testing toxin or antitoxin. The strength of tetanus antitoxin is determined in practically the same way as diphtheria antitoxin, except that the unit is different. A unit of tetanus antitoxin is the amount required to neutralize a 1,000 M.L.D. *(minimal lethal dose)* of tetanus toxin, for a 350 gm. guinea-pig. The United States Public Health and Marine Hospital laboratories supply the different manufacturers with standardized toxin and antitoxin for testing purposes. Diphtheria and tetanus are not dental diseases, nor have they any direct relation to diseased mouth conditions; therefore, the dentist will not be called on to administer the commercial antitoxins prepared for these diseases; but our profession is so closely related to medicine today that a knowledge of the treatment is of value.

In the annual report of the Los Angeles Orphans Home (1925), where I supervise a dental clinic recently established and maintained by the Kiwanis Club of Hollywood, we read the following: "Owing to the immunization treatment we have had no diphtheria for the past year. It has now been four and one-half years since we have had a case, and we may reasonably conclude that diphtheria with us is a thing of the past. We feel that the toxin-antitoxin treatment has proved very satisfactory in our case." When we take into consideration the fact that the Home always has had about 100 children, many with bad mouth conditions before the dental clinic was functioning, this is a remarkable record.

Serums.—These are more complex in action and much less satisfactory for therapeutic purposes than are the antitoxins. With these products, the contained antibodies are expected to resist the bacteria themselves, not simply neutralize their toxins, as is the case with antitoxins. In the manufacture of serums proper, horses are immunized by inoculation first, with dead cultures, and, secondarily, with increasing doses of living cultures of the specific bacteria, until the blood contains substances that directly or indirectly destroy either the life or the activity of these specific bacteria. If the toxin of the microorganism is its chief pathogenic weapon, then the body cells produce an antitoxin; if the offensive substance is an endotoxin, as in typhoid infection, the body produces among other antibodies bacteriolysins, which will break down the bacterial cells; and in other infections, opsonins, which cause the phagocytes to destroy the bacteria. The substances in the immune serum that destroy the life or the activity of the specific germ are collectively spoken of as antibodies. They have never been isolated as specific chemical substances, but their presence is assumed in the

serum from their definite effects on bacteria. The names given to the more important antibodies are bacteriolysins, bacteriotropins, opsonins and agglutinins. Of these antibacterial substances, the bacteriolysins are those which both kill and dissolve the bacteria, and are considered to be the antibacterial bodies proper. For example, take a serum from an animal immunized against the streptococcus germ, and put into it some living streptococci. After a brief period of incubation, an examination will show that the streptococci are not only killed but have been dissolved as well. This phenomenon is called bacteriolysis.

Aside from the direct killing of the bacteria by the blood stream, the invaders may be taken up by the leukocytes, though not, as a rule, until they have been acted on by other substances in the serum, mentioned above as bacteriotropins and opsonins, according to whether they resist moderate heat or not. The agglutinins are antibodies that act directly, causing the bacteria to gather in clumps. They are valuable in diagnosis on account of their specificity, but probably have no important action in protecting the human organism from an infection.

Serums are indicated in severe infections already developed, when prompt establishment of immunity (passive) is necessary to the body cells. In these cases, the specific serum is used. Serums should also be employed as prophylactic agents in warding off infections that have a relatively short incubation period. Among the more important antibacterial serums may be mentioned antistreptococcus serum, antistaphylococcus serum and antipneumococcus serum.

Vaccines.—These, sometimes called bacterins, are suspensions of killed bacteria in physiologic sodium chlorid solution, usually with the addition of some preservative such as 0.4 per cent of cresol or 0.5 per cent of phenol. More or less confusion has existed in the minds of physicians and dentists as well as of the laity in regard to the proper use of the words "serum" and "vaccine." A serum, as has been explained, is the blood serum of an animal that has been immunized against the specific bacterial toxins or against the bacteria themselves, and contain the necessary antibodies to be directed against the toxins or against the bacteria themselves, on injection into the body. On the other hand, vaccine (*vacca*, a cow) was the term first used by Jenner to designate the cowpox virus that he used for protective inoculation against smallpox. Later, Pasteur applied it to suspensions of dead or attenuated bacteria. Today, we qualify it slightly and speak of *bacterial vaccines*. It should be remembered that vaccines contain no antibodies.

An autogenous vaccine is one made from the bacteria infecting the person immunized. A stock vaccine is one made from standard cultures of the germ. A mixed vaccine is one prepared from more than one species of bacteria. Vaccines are indicated when the purpose of using the remedy is only to stimulate the body cells to a greater production of antibodies. Prophylaxis by immunization is usually to be preferred, except in cases mentioned under "indications for serum therapy." Not infrequently, it is desirable to combine the two forms of immunization since the serum will give prompt and immediate protection at a critical moment and the vaccine

will stimulate the formation of an excess of antibodies, which will reinforce and maintain the immunity for a longer period.

It may be said that bacterial vaccines are of value in localized affections, especially those due to infection by the staphylococcus and the streptococcus. The importance of focal infection as an etiologic factor of local and general disease is now well recognized. Foci of infections (circumscribed areas of tissues infected with pathogenic microorganisms) may be primary and secondary. Primary foci are usually located in tissues communicating with mucous or cutaneous surfaces (teeth, tonsils, etc.). Secondary foci are the direct results of infection from other foci through contagious tissues or at a distance through the blood stream or lymph channels (hematogenous or lymphogenous transportation). Dental literature today is replete with articles on the relation of focal infection to systemic disease. It has been definitely shown by Murphy, Billings, Duke, Rosenow, Rhein, Hartzell, Logan, Grieves, Price, Rickert and others that infections about the teeth, especially from periodontomas and dento-alveolar abscesses, may result in systemic diseases involving the joints, heart, kidneys, stomach, and other organs and tissues. Gilmer, Moody and others have found that the predominating organism in conditions resulting from a gangrenous pulp, and therefore, the group active in bringing about the decomposition, is a streptococcus. The use of antistreptococcus vaccines in the treatment of chronic arthritis and other affections resulting from a streptococcus infection about the teeth and tonsils have not been encouraging, though some writers have reported cases in which the treatment afforded much relief and, in some instances, effected a cure.

Among the more important bacterial vaccines may be mentioned streptococcus vaccine and typhoid vaccine. Smallpox vaccine or virus is the pustular material of vaccina or cowpox removed under aseptic condition from vaccinated animals of the bovine species. In using a vaccine for streptococcus infection, it is understood that the eradication of the foci of infection is of the first and prime importance. This in no sense means that pulpless teeth involved need necessarily be extracted. Other factors enter into this phase of the problem. In the past few years, thousands upon thousands of pulpless teeth have been needlessly extracted because of the hysteria produced by the publication of exaggerated reports of cases cured, based on unfounded and insufficient data, in which the teeth were thought to be the primary foci of infection. Howard T. Karsner, pathologist of Western Reserve Hospital, Cleveland, says: "It is now well established among critical investigators of infectious diseases that where two infections coexist the eradication of one is following in many cases by improvement in the other and this can be definitely applied to instances where the two infections are definitely attributable to different organisms. The fact that eradication of dental infections often leads to marked improvement in other conditions cannot be accepted as proof that the two are related as to cause and effect." Statements such as this, coming from authorities, are gradually but surely causing dentists to practice saner methods and to hold a more hopeful view of the

recently muddled pulpless tooth problem.

The use of vaccines of various kinds has a creditable record. Typhoid fever during the World War was practically eliminated by the use of typhoid vaccine. Among the 4,000,000 men in the United States Army, there were only 158 deaths from typhoid. It is reported that in 1925 there were only 453 cases of typhoid fever in Chicago; that, under the conditions of twenty years ago, there would have been 6,000 cases. The value of smallpox vaccine was shown this past winter by the small number of cases of smallpox in those states in which vaccination is compulsory over those states in which it is not.

Thus, it has been shown that the mortality rate from infancy to the age of 30 has been markedly decreased, largely because of the control of infectious diseases by biologic therapy. Time will not permit me to discuss at any length the cause of the increase in the mortality rate from the ages of 30 to 60, nor the cause of the increase in insanity and criminalism. We know that the people of today, for the most part, are living artificial lives and expecting natural results. It simply cannot be done. The sooner civilization realizes this fact, the better for all concerned.

Some writers are continually speaking of fundamentals in stressing certain phases of health. The real fundamentals of this problem lie deeper than the sciences of pathology, bacteriology, immunology or blood chemistry. The most important of all the sciences to the present civilization is the science of right living, the science of mankind. Herein lie the fundamentals of the whole problem of disease. When people have the moral courage to admit that their ailments, or those inherited by their innocent children, are caused by vicious habits, such as excesses or over-indulgence in eating, drinking, sex life, anger, worry, lack of personal hygiene or whatever else the individual knows to be the real cause, then, and then only, will we be in a position to speak of fundamentals. Most people, with true characteristic weakness, are quite content to have the physician or dentist trace the cause of their ailments to the teeth, tonsils, ovaries, prostate, gallbladder or other innocent organs or parts of the body. I repeat that the true science of health is the science of right living.

If volumes are to be written on this subject, they had better be written in plain, simple language to drive home this significant fact. Dentistry has been altruistic in her efforts to eliminate dental service by teaching oral hygiene or so-called preventive dentistry. To eliminate disease, we must do more than this—we must accomplish more than the correction of diathetic habits; we must begin at the bottom and broadcast to the world the science of right living, the science of mankind. With the tendency of the times, I fear that workers along the lines of health service have a great problem before them. But we must not be discouraged. Let us keep up the fight along deeper and broader lines. If each of us would help set the example by our own lives, the problem would be greatly simplified. Is this expecting too much of the trained health service workers of today?

DISCUSSION

Thomas B. Hartzell, Minneapolis, Minn.: Dr. Buckley has written a paper of great value. He deals with a subject that is not well understood by many men in our profes-

sion and he has made that rather difficult subject clear and simple. No doubt the future of medicine lies in the science of prevention. Few diseases are curable by specific therapy. There are a few notable exceptions, namely syphilis, malaria, trypanosomiasis and perhaps one or two others, but the infections that are prevalent on this hemisphere are not readily amenable to specific therapy and therefore we must look to preventive medicine in the control of practically all infections and infectious diseases. We know how easy it is to control smallpox, typhoid fever and the intestinal infections. We likewise know how absolutely refractory these infections are to therapeutic measures. We know likewise that preventive dentistry will preserve the teeth until a ripe old age, but that dental surgery actually cures very little. It can only reconstruct in a modest way after the havoc wrought by various infections. Therefore, as Dr. Buckley has pointed out, our hope lies in immunology and preventive medicine. He has mentioned the various immunologic measures, such as the use of the serums, antitoxins and vaccines. Serums and antitoxins are of value in certain acute conditions, such as diphtheria, and yet, in many of these infections, when well advanced, the antitoxins fail to save the situation. It is a known fact that an antitoxin cannot repair the damage done by a toxin already at work. In the case of diphtheria, we are able to save the patient by the use of antitoxin when it is given early in the disease, before large quantities of toxins have attacked the tissues. In this instance, the antitoxin only neutralizes toxin which is formed subsequent to the injection. Again, in tetanus, the so-called lockjaw, the antitoxin will prevent tetanus only if it is injected during the period of incubation. It does little good after tetanus has set in, except to neutralize the toxins that are being formed; in other words, a passive immunity is of only temporary value. It is the active immunity that is really worth striving after. By active immunity, as Dr. Buckley has pointed out, we understand a condition in which the body is itself active in developing the resistance sometimes spoken of as immunity. Such immunity follows certain infections or vaccination. It is well known that immunity follows some infections quite regularly, while other infections not only are not followed by immunity but there seems also to be rather a higher susceptibility. The latter condition is particularly true of streptococcic infections. Here, we find that immunity lasts but a short time. This condition is one that has puzzled and is still puzzling immunologists. Why a disease such as scarlet fever, caused by streptococcic infection, is followed by an immunity that is more or less permanent, and erysipelas or puerperal sepsis, likewise caused by streptococci, is not followed by such an immunity is a puzzle to medical men. Undoubtedly, this problem will sooner or later be cleared up. One of the objections to immunization against various diseases on a larger scale has been the severe reactions that sometimes follow vaccinations. The reactions following smallpox vaccinations may, as you all know, be quite severe at times. Likewise, the vaccinations against typhoid and dysentery organisms may be followed by local and general reactions, which, from the patient's standpoint, are undesirable. Scarlet fever vaccination has, until recently, been difficult, owing to the very severe reactions that usually follow the administration of the toxin. This question has been, we believe, solved by work done at Minnesota under the auspices of the American Dental Research Commission, in which it has been found that the various bacterial toxins may be neutralized by a perfectly harmless substance, sodium ricinoleate. It has been shown conclusively that sodium ricinoleate detoxifies practically all bacterial toxins instantly, and that such detoxified toxins are splendid antigens; that is, immunity follows the administration of these toxins very promptly. It has been found that it is possible to immunize against scarlet fever within the period of incubation; that is to say, after a child has been exposed to scarlet fever, it may be protected from the disease by prompt vaccination. We believe that this work will revolutionize the methods of preventive medicine and I predict that, in a few years, perhaps less than a decade, many infectious diseases that up to the present time have not been within our control will be practically wiped out.

CLINICAL AND RADIOGRAPHIC OBSERVATIONS ON FIXED AND SEMIFIXED BRIDGEWORK*

By STANLEY D. TYLMAN, B.S., D.D.S., Chicago, Illinois

THE problem of the partial denture, either fixed or removable, must be adjusted to the ascertained principles of biology, physics and mechanics. A disregard of one renders the other two incapable of attainment; an overemphasis of either one is likely to jeopardize a disinterested study of this phase of restorative dentistry.

In studying, diagnosing and planning restorations for partially edentulous mouths, we note that no two mouths present exactly the same conditions; that no panacean restoration is capable of meeting the requirements in all cases. It is not preeminently urgent that the bridge be fixed or removable, but it is of vital importance that it restore function, maintain health and prevent further injury. It is not so much a question of using an inlay crown, clasp or any other attachment for retentive purposes, as it is a question of placing the mouth on its privileged basis of health.

The problems of the fixed and of the removable bridge advocates are identical. Both must restore missing teeth with appliances that are efficient and esthetic and that serve to promote the health of the body. Unless good judgment and skill are exercised in the selection and construction of the bridge, it will fail, be it fixed or removable.

That there exist glaring failures of the fixed type is true, but does the cause lie in the principle of fixation itself or in the disregard of the mandates of biology and mechanics? If fundamentals are understood and applied, methods need not hinder us.

I once read a story of an artist giving a concert. During a difficult rendition, three of his violin strings snapped, leaving but one—the G string. Unabashed and to the amazement of his auditors, he faultlessly completed the difficult sonata. He was a master; he was not stopped in his rendition, for he understood principles; he was not bound by one technic or method. So should we be able to attain the desired results guided by established facts rather than by phantom theories.

The statements following and the conclusions at which we arrive are based on observations and studies extending over a period of years. We have observed conditions and recorded them.

Prior to undertaking reconstructive work of any type in the mouth, there are certain factors that must enter into our final decision. Since no structure is stronger than its foundation, this phase should receive careful thought. We cannot fail to appreciate the fact that the human body in its entirety is the real

*Read before the Section on Partial Denture Prosthesis at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 25, 1926.

foundation of any effort at reconstruction. For the purpose of establishing a basis, a thorough physical examination of the patient should not be omitted, for frequently we fail to take into consideration the remote etiology of the present impairment of the mouth. Important as it is to restore missing teeth, it is of greater importance to the patient that we understand why they were lost, in order to prevent additional losses. It is for us to determine at the time whether the patient may have a bridge, and whether the tissues will be able to adapt themselves to the new condition without degenerating. An exhaustive ocular, digital and radiographic survey of the teeth, paradental tissues and edentulous areas is essential, this in conjunction with full mouth study models.

Employing these diagnostic aids, what are the objectives? Let us first establish the tonicity of the investing and supporting tissues, also the presence of pathologic lesions, acute or chronic, and to what degree they have pejorated the normal function or texture of the teeth and their paradental tissues. No bridge should be placed in the mouth until the tissues have been restored to normal.

Our next objective is to determine which can safely be retained as abutments. A tooth whose pulp and investing and supporting tissues are normal in structure, form and position in the arch, is the ideal abutment or pier. This does not preclude the use of properly treated, malformed or malposed teeth. We have found that a tooth deviating from normal beyond an inclination of 12 C. is not a safe abutment. The supporting tissues will not endure the leverage.

There are those who confine their abutments to vital pulps only. This conveys an image of a holocaust. Of 723 abutments, we find that 558 were vital teeth, while 165 were treated; of the latter, all have responded well with the exception of three, which were extracted. Surely this percentage justifies a continuance of a tolerant attitude toward the properly treated tooth as an abutment.

If excessive mobility of teeth exists, the cause should be determined. If due to a thin, weak or possibly a missing alveolar process, use of the teeth as abutments is contraindicated; if due to traumatic occlusion, the condition may be meliorated. Previously placed fillings, crowns and partial restorations should receive our attention. All that do not conform to the requirements of hygiene, correct occlusion and contour should be removed without hesitation.

The acceptibility of an abutment tooth is determined to a large degree by its physical makeup. Often, we find a tooth the coronal portion of which is out of proportion to the length to the root. Radiograms and a digital buccolingual movement will help to disclose this condition. The use of such a tooth for an abutment dooms the restoration to failure within a short time owing to the resultant leverage. Nor does a long root suffice of itself: it must have a healthy and adequate periodontal attachment to the alveolus. When the detachment exceeds one half the normal amount, the prognosis is unfavorable. Elongated, greatly converged or diverged teeth may have to be removed. When we find that the axis directions of the abutments are not reasonably near the parallel, they must first be made so or the fixed restoration is subordinate to the removable.

Another important consideration is

the relative number of abutments and pontics. In exceptional cases, the pontics may outnumber the abutments, especially when the opposite arch carries a removable denture, full or partial. It is interesting to find that in the 369 consecutive bridges, the aggregate number of units involved is 1,130, an average of three units to the bridge. Of this number, 723 are abutments and 407 are pontics. The records further indicate that the two sides of the arch are equally susceptible to caries, for the left side has 378 abutments, while the right has 345. In distinguishing between upper and lower restorations we find the difference more marked; for the upper abutments number 401, while the lower number 322. The teeth used as abutments were distributed as shown in Table 1.

TABLE 1.—DISTRIBUTION OF TEETH USED AS ABUTMENTS

Upper	Teeth	Lower
34	Central incisor	0
19	Lateral incisor	4
106	Cuspid	13
49	1st bicuspid	41
88	2nd bicuspid	109
45	1st molar	20
58	2nd molar	112
2	3rd molar	23

On this basis, the upper teeth arranged in the order of their importance as bridge abutments were: cuspid, second bicuspid, second molar, first bicuspid, first molar, central incisor, lateral incisor and third molar. The order of the lower differs somewhat: second molar, second bicuspid, first bicuspid, third molar, second molar, cuspid, lateral incisor and central incisor.

The question of stress is another interesting problem. We are told that the majority of fixed bridges are lost through overload. We have accepted the theory that the abutment teeth carry the cumulative normal poundage of the restored region. In a bridge restoring the bicuspids, it is stated that the cuspid and the molar abutments, in addition to their own load, carry the added normal poundage of the bicuspids, a total of 300 to 400 pounds. Let us ascertain the facts to see whether we have not ascribed to overload the evils of leverage.

Since the buccolingual or the mesiodistal movement of a tooth is normally involved, it is presumed that the vertical direction is the sufferer from the supposed overload. Some of us have used our teeth to crack a nut. Often, we were compelled to stop before attaining our end. Was it because the muscles of mastication had reached their maximum power, or was it because of the pain experienced in the periodontal membrane? Teeth will not endure pressure greater than that for which they were suited, the periodontal membrane acting as the gage. It is possible, and it happens that the power of endurance and load capacity increases gradually with the continuance of the increased load.

We have recorded the bite in poundage of the 369 patients and discovered some interesting data. It has been stated that the average normal bite of a patient is 175 pounds. Table 2 gives the records as to average bite of the 369 patients wearing a bridge. The first figure represents the poundage on the restored side, the second that of the opposite. A further analysis reveals that, for women, the average bite of the uppers on the restored side is 38 pounds, while on the normal natural teeth it is 45. For the restored side on the lower

teeth, the average is 42, while on the natural teeth, it is 46 pounds.

TABLE 2.—AVERAGE POUNDAGE OF BITE OF PATIENTS WEARING BRIDGES

Women

Tooth	Upper	Lower
Central incisors	23-28	---- ----
Lateral incisor	18-22	---- ----
Cuspid	37-42	34-34
1st bicuspid	44-49	38-44
2nd bicuspid	47-53	44-52
1st molar	53-61	37-41
2nd molar	47-59	55-62
3rd molar	---- ----	42-44

Men

Tooth	Upper	Lower
Central incisor	38-39	---- ----
Lateral incisor	46-47	35-35
Cuspid	44-49	50-67
1st bicuspid	59-70	60-72
2nd bicuspid	57-67	59-69
1st molar	64-79	66-83
2nd molar	67-86	76-87
3rd molar	---- ----	63-78

For men, we find the average slightly higher. In the upper restorations, the poundage average is 53, while the natural teeth average 62; in the lower restorations, the average bite is 58 pounds, while the natural teeth show a registration of 70 pounds. Such a marked variance between the 175 pounds which G. V. Black states is average for the normal mouth and the 52 pounds which is the average for mouths having partial restorations is indeed significant. Do not these figures lead one to believe that just as Nature increases its powers of endurance gradually when a load is added, so also does she decrease these powers in proportion to the disuse of teeth? The latter condition prevails when edentulous areas are permitted to exist for any length of time without proper restorations being inserted. We make it a practice to recall patients every six months or oftener. At these periodical examinations, which are clinical and radiographic, we obtain, among other data a record of the bite on the gnathodynamometer. Invariably, we find that, in teeth with vital pulps, the poundage increases several pounds semi-annually. This is also true of the pulpless teeth, but to a less marked degree. We believe now more firmly than a few years ago that the fixing of two abutments to a pontic is not beyond the compensatory powers of Nature, provided the mechanics of occlusion are correct.

To aid us in the study of the occlusion in each case, a set of accurate study models mounted carefully on an adjustable articulator is indispensable. It will enable us to study the mandibulomaxillary relation and gain cognizance of unevenly distributed forces. An apparently normal mouth often discloses abnormalities when subjected to a study from the many angles and positions possible with study models. Undisclosed, incipient lesions, present prior to the placement of a bridge, have often been called the effects, whereas, in reality, they are the causes of fixed bridge failures. It is for this reason that we emphasize so strongly, and devote the time necessary for a thorough diagnosis. Having done so, we are better prepared to design and construct the bridge.

An understanding of the masticatory apparatus and its component parts together with their structural form and functions, individually, relatively and collectively, is essential. The attachment, or the intermediate connection between the abutment and the pontic, is the first component part to receive attention. The ideal should embody certain qualities, the first and most impor-

tant of which is pulp conservation; the second, extension for prevention; the third, conservation of tooth structure; the fourth, a mechanical retention sufficient to withstand displacing forces; the fifth, restoration to normal tooth form; the sixth, esthetics.

The function of any attachment should be threefold: retentive, restorative and preventive. It must retain the bridge, restore normal anatomy to the tooth and protect it and its investing tissues from injury. Varied demands necessitate different attachments. Under certain conditions, the weaker will suffice; while, at other times, the strongest will scarcely meet the requirements.

The attachments at our disposal are inlays and crowns. Of the inlay group, the two surface types are considered the weakest. They are used when the bite is abnormally weak or where the inlay will support a rest. They are contraindicated with the soldered joint. An exception is sometimes made if the opposing arch carries a removable denture. When a tooth is extremely short, this type is not used. It is interesting to note that of 126 fixed bridges with 240 abutments, there were only two two-surface inlays used, and one of these was dislodged. In semi-fixed bridges, however, we find that of 483 abutments, there were fifty-three two-surface inlays in the anterior teeth and sixty-five in the posterior, a total of 118. Of this number, only two were dislodged.

The next stronger type of attachment is the three-surface casting. This type may be used with soldered connections provided the coronal portion of the tooth is of sufficient length occlusogingivally. This precaution is necessary to insure a sufficient tensofrictional contact between the gold and the tooth structure. We find that, in the fixed type of bridge, this attachment was used, once in the anterior teeth and fifty-two times in the posterior; while in the semifixed type of bridge, it was used four times in the anterior teeth and 200 times in the posterior; a total of 257.

If the stress of occlusion, span or condition of teeth demands greater strength, the three-quarter attachment is used. In its present state of refinement, it meets the requirements of an ideal attachment. It frees us from the constant dread of pulp involvement; and its use renders it unnecessary to encroach on the pulp in order to obtain mechanical retention. The beveled gingival margin is more practical than the pronounced shoulder, since the resultant small amount of tooth structure removed makes possible thin castings using hard gold. This reduces the danger from thermal shock to a minimum. The attachment is esthetic and its technic quite simple, bringing it within the scope of every man. We have had occasion to use it 103 times, seventy-five times on anterior teeth and twenty-eight times on posterior.

At this time, I wish to mention the "slice preparation." We believe that this attachment, with its recent modifications, will be used more extensively. It has its indications.

When all the former types prove inadequate to the demands, the full gold crown is indicated, for it is the strongest attachment available. It is used on teeth the coronal portion of which is short occlusogingivally or where the teeth are imperfect in texture, form or position. The teeth most commonly employed are the molars, and

occasionally the bicuspids. This attachment has been abused extensively, but if constructed carefully by the pure-gold band and cast contour technic, no apologies need be offered for its use. In fact, it is the most widely used attachment. According to our records, of 723 abutments, 192 carried the gold crown. To allay any prevailing solicitude, let me cite the hysterognosis of this attachment. During the semi-annual check-up of bridges, the outstanding surprise has been the normal health of the investing tissues adjacent to the crowns. Two or three years have elapsed and the gum tissue is normal. In but three instances is there any indication of an inflammation or a recession, and these were due to improper contour or occlusion.

Of the remaining abutments used, thirty-seven were swaged base Richmond crowns and fourteen porcelain jacket crowns.

Pontics have received less attention than any other part of the dental bridge. Though they may be constructed of either gold, porcelain or gold and porcelain, the former two have their limitations. It is the gold-porcelain type that is most general in its application. The ideal pontic should simulate the natural tooth as closely as possible. Up to a recent period, we placed bridges the pontics of which consisted of a porcelain facing ground to fit a scraped cast; then backed, assembled and soldered in one operation. Little attention was paid to the occlusion, contour, cusp relation, contact regions, embrasures or hygiene. No wonder that, in a short time, these would return in such a condition as to justify some of the diatribes launched against dentistry. We must not lose sight of the fact that the pontic is the prime objective of a bridge. We have had pioneers in this work who spent a great amount of time and effort to point out the essentials of a permanent, esthetic and hygienic pontic. Let us consider these essentials briefly. Without exception, no porcelain should come in contact with the mucosa unless glazed. Ground porcelain, unless reglazed, will absorb fluids which, fermenting, act as irritants to the membrane. Glazed porcelain is not only impervious to moisture but it also presents to the tissues a smooth and nonirritating surface with no danger of mechanical irritation. A tip of porcelain, convex in all directions and brought without pressure into close contact with the tissues, will, after a few years, be clean and the tissues adjoining it normal.

It might not be amiss to designate some of the dangers encountered with this type of pontic. There are two general types employed: the root and the tip with its modifications. The former is placed within the alveolar socket, the latter in contact with the crest of the ridge after it has healed. A few years ago, the possibilities of the porcelain root created great enthusiasm. Some placed it indiscriminately. Not long after, trouble was encountered in secondary infections, recessions and monument-like cones. Like other things, this type of pontic has its limitations. We found that it was necessary to have a sound alveolar plate of bone and healthy investing tissues. Moreover, the root could not extend into the socket to a greater depth than one third its normal distance; and care had to be exercised to avoid the impingement of porcelain against bone and to eliminate its use where extensive pathologic condi-

tions existed. After recognizing these limitations, we realized its full benefits.

In constructing a pontic of the baked tip variety, there are several points to be remembered: (1) the widest part of the pontic mesiodistally is through the contact points just lingual to the facing, and these points are in the gold and not in the facing; (2) the pontic is narrowed mesiodistally in its lingual one half. This results in widened lingual embrasures, with the resultant reduction of the occlusal surfaces and stresses. An ideal pontic tapers from the contact points to a gingival end. The tip of porcelain rests on the center of the ridge or a trifle to the buccal.

One of the important things neglected in the construction of a pontic is tooth form. How many of us have noted the comparative distances between the buccal and the lingual cusps of a lower first molar and its greatest buccolingual diameter? You will recall that if the greatest diameter measured 12 mm., the distance from the buccal to the lingual cusp point averaged from 6 to 6.5 mm., or nearly one half. And yet, how many bridges are placed on which the cusp to cusp distance almost equals the greatest diameter? Let me emphasize the significance of this arrangement as found in Nature. We are aware that doubling the diameter of a pipe increases its capacity four times; doubling one dimension of a square will double the surface area, but doubling both dimensions increases the square area four times. We can readily draw the analogy between these measurements and the importance of correct occlusal surface areas as determined by their buccolingual and mesiodistal dimensions.

Another point to stress is the importance of marginal ridges and grooves. Unless the marginal ridges are well formed and properly placed, a low degree inflammation in the interproximal tissues will result. Grooves that are regularly found in teeth should be accentuated and other supplementary ones placed where they will aid the escape of food. The latter are usually cut through the marginal ridges into the lingual embrasures.

The final component of the bridge to be considered is the connector or means of uniting the pontic to the attachment. There are two types—the rigid or soldered union and the flexible or rest and socket type. We are led to believe that the flexible type should be used universally except where the span is too long or the teeth too mobile. Our data indicate that the semifixed or flexible outnumber the fixed two to one. We cannot deny the fact that there is a certain amount of movement in teeth, but not to the degree claimed by some. Even when both attachments are soldered to the pontic, there is still a sufficient mobility. To say that fixation produces pathologic changes is not in accordance with our findings, clinical or radiographic.

Of the 723 abutments, 558 showed vital pulps. Up to the present time, only two of pulps have died, the other 556 being normal. Of the total number of abutments, twenty-nine show an osseous involvement, but with the exception of three, these were all treated teeth. Likewise there were only twenty-eight peridontal involvements, of which twenty-five were also treated teeth.

You no doubt have heard dentists condemn fixed bridges because the radiogram revealed a so-called "pathologic" thickened membrane or "osteitis." To us, these manifestations represent a com-

pensatory effort on the part of Nature to harmonize the teeth with their new environment. In this connection, permit me to quote a recent statement of F. B. Noyes.

> We are apt to think of the tooth, the cementum, the peridental membrane, the alveolar process and the periosteum as separate entities. The more one studies sections of these tissues, the more he will be forced to realize that they are only parts of one thing, that, in the development, the greatest characteristic of all supporting tissue, the connective tissue, is the ability to respond to other environments and change from one form to another. As you study sections of the peridental membrane, particularly from young animals, you will often find the greatest difficulty in determining just exactly the line between bone and peridental membrane. The fibrous tissue is converted into bone. Bone is built up around these fibers and imbeds them as the fibrous tissue is transformed into bone. There is no line, or at least it is difficult to put your finger on a line, of differentiation. These tissues, in the development of the individual, show a reaction to their environment, and the particular environment is the support of force. We sometimes say that the fibrous tissues is arranged in a beautiful way to support the force that the tooth receives. That is true, but it is more important to recognize as true the fact that the arrangement is the result of these forces. Now, if this is true, and it certainly is, the tissue which should support that kind of strain is the tissue which Nature will build in response to that sort of strain. . . .
>
> What would you consider the meaning of a thickened membrane? The addition of two teeth, or the force received on two teeth in addition to the one which makes the abutment, increases the amount of force that that membrane receives and it increases also, slightly, the amount of movement that that tooth shows in function. The thickening of the membrane I should think would be a perfectly normal reaction for that necessarily slightly greater movement and nothing more.

CONCLUSION

There was an average gain of 81 per cent from the plus to minus in the susceptibility column, and an 18 per cent improvement in health from poor to good after the bridges were placed.

Another interesting feature is the relative number of men and women patients wearing bridges and the ages at which this type of restoration is prevalent. There were 233 women as compared to 136 men. The distribution according to ages is as follows: men: semifixed bridges: 10 per cent, 17-19 years; 50 per cent, 20-29; 25 per cent, 30-39; 10 per cent, 40-49; 5 per cent, 50-55; fixed bridges: 2 per cent, 17-19; 38 per cent, 20-29; 43 per cent, 30-39; 15 per cent, 40-49; 1 per cent, 50-56; women: semifixed bridges: 5 per cent, 17-19; 33 per cent, 20-29; 47 per cent, 30-39; 13 per cent, 40-49; 5 per cent, 50; fixed bridges: 2 per cent, 17-19; 30 per cent, 20-29; 45 per cent, 30-39; 15 per cent, 40-49; 1 per cent, 50-56.

These figures indicate that women need bridges most between the ages of 30 and 40, while men need them between the ages of 20 and 30. Whether these percentages connote an economic or a biologic problem is a question.

·Medical and Dental Arts Bldg.

CANCER PREVENTION*

By FRANCIS ASHLEY FAUGHT,† M.D., D.D.S., Philadelphia, Pennsylvania

I REPRESENT a national movement, fathered by the individual state and component county medical societies of this country, to teach physicians, dentists, nurses and the public the early signs of cancer and the great importance of early diagnosis and prompt treatment, if successful prevention, control and cure of this disease is to be accomplished.

Physicians are now being trained by society meetings, by special articles, by precept and by individual instruction, to become educators of the public in this campaign; and the public is gradually being brought to realize, through public lectures and printed circulars, the vital importance of early diagnosis, and are learning to recognize the early signs of cancer and to seek advice and treatment promptly.

This campaign of education began in 1910, and since that time, progress in the prevention and control of cancer, while far from satisfactory, is very encouraging. The increasing number of cures accomplished, when viewed as a whole, speak well for better results in the near future.

That something has been accomplished is well known by the following figures: In 1910, in superficial cancers, the average time between the discovery of the first symptom and operation was eighteen months. In 1923, this interval had been reduced to fourteen months. During the same period, in this same type, the average time between the first consultation in suspected cancer and the institution of proper treatment was reduced from thirteen months to four and a half months.

In deep seated cancer, the delay between the first symptoms and operation had been reduced from fourteen months, in 1910, to eight months in 1923; while the average time between the first consultation with physician and operation fell from twelve to four months.

We believe that what has been done in the prevention, arrest and treatment of tuberculosis can, by persistent education and instruction, be accomplished in cancer.

The general dissemination of true knowledge and the elimination of fear has reduced the annual tuberculosis mortality 41 per cent in the same thirteen-year period. Today, the tuberculous patient is cheerful and optimistic. He expects to get well and does get well. The cancer patient should be brought to the same state of mind.

In the registration area in the United States, approximately 100,000 die an-

*Read before the senior dental classes of the University of Pennsylvania and the Temple University, April, 1926; under the auspices of the Committee on Cancer Prevention and Control of the Philadelphia County Medical Society.

†Physician to the Misericordia Hospital.

nually of cancer. This means that there occurs one death in every ten persons over 20 years of age. Furthermore, cancer mortality, during the past forty years, has increased at the rate of 2.5 per cent a year.

This increase is due partly to better knowledge and more accurate diagnosis, and a decrease in infant mortality, but this does not account for it all. It is believed that conditions of modern life are partly responsible.

To recognize and treat cancer, we must know what it is. Cancer is a lawless growth of body cells which starts in some way not yet satisfactorily explained, which continues more or less rapidly, and which, if not arrested, finally destroys life. It is like a fire which starts in one small spot and can only then be easily extinguished, and which, if neglected, soon becomes a hopeless conflagration.

In its earliest stage, cancer is usually curable if treated promptly and skilfully; but, if allowed to spread, it soon gets beyond control and becomes incurable. This emphasizes the importance of early diagnosis and immediate and adequate treatment.

While we do not know the biologic cause of cancer, there is enough known today about cancer to insure a cure of one-half the cases, provided they could be seen and treated early enough. Even now, scientific investigations are under way in all parts of the civilized world, and hundreds of thousands of dollars are spent every year in the search for the cause of cancer.

We do know that the commonest exciting cause of cancer is irritation, and this fully explains why most cancers originate. A clean mouth never develops cancer, a dirty mouth may. This irritation usually must be chronic and persistent.

The dentist's responsibility in the control and prevention of cancer is second only to that of the physician. In some respects, the dentist has an advantage over the physician in that he is dealing with generally healthy individuals, who come to him periodically for examination and treatment. At such times, patients often mention facts regarding their general health which may suggest the early signs and symptoms of cancer; and the dentist should be on the alert to recognize them.

A spirit of cooperation between the two professions has rapidly developed during recent years, but there is room for even greater coordination of effort.

The dentist can do much to allay the common fear, dread and prejudice which exists in the public mind today regarding cancer and, by precept and instruction, he can educate patients to be as frank regarding cancer as they are regarding any other medical condition. The dentist should assume this obligation because he is not doing his whole duty as a member of an important branch of the healing art if he does not apply his knowledge when the opportunity presents.

Since the source of many mouth conditions may be found in other parts of the body, it is within the province of the dentist to question his patients regarding their past medical history and their present general health. If this is done consistently, an unconscious ability to detect precancerous conditions will develop. If an attitude of alertness is adopted by the dental profession generally, the number of cases recognized (approximately 4 per cent of cancer occurs in the mouth) will be greatly

augmented and many more lives saved through early diagnosis and prompt and efficient treatment. A word of advice to the patient who, seeking dental service, shows evidence of systemic disease is often all that is needed.

When the patient comes in with an aching tooth, for examination, for treatment or for prosthetic work, the dentist should always examine the mouth and adjacent structures carefully for precancerous conditions, such as leukoplakia, chronic fissures, old ulcers and indurations. If he finds something that he does not understand or recognize, he should seek help by consulting a physician or surgeon. The patient will appreciate this course, and the position of the dentist will be strengthened.

There should be no fear of unduly alarming the public: they must be aroused if anything is to be accomplished. If by being aroused, the people are driven earlier to consult a physician when they suspect they have the symptoms of cancer, 90 per cent will find that they do not have cancer, and the other 10 per cent will be taking the surest road to a cure.

You should impress on your patients the fact that cancer is neither communicable or hereditary. No one has ever contracted cancer from association with it; neither has any physician or nurse been known to contract the disease while attending a case.

Cancer is not hereditary, although we recognize in cancer, as in other diseases, a family susceptibility. Certain families furnish a soil where favorable conditions exist and where cancers seem to develop more easily.

As dentists are often asked about different methods of treatment, it behooves each one to know the truth regarding cancer and the many so-called cancer cures, in order to be able to prevent needless loss of time, waste of money, unnecessary expenditure of energy and useless suffering.

There is no simple, mild medical treatment, either for internal or external use, that will cure cancer. Neither is there any serum or other specific. All so-called cancer cures advertised in the lay press are humbugs and swindles. Up to the present time, there has been developed no efficient treatment for curing cancer, except surgery, the roentgen ray and radium.

In spite of these facts, many persons who are apparently intelligent, educated and sane spend money, and waste valuable time on "cancer cures," only to learn that, in so doing, they have probably lost their chance of life by needless delay.

To repeat: Cancer always begins as a localized disease and as such can be successfully treated and removed by local treatment. This treatment is never medical. Application of anything but the mildest and blandest lotions is absolutely contraindicated because the mere use of irritating substances, caustics, etc., may turn a simple ulcer into one of malignant degeneration in a very short time.

In the reduction in cancer mortality, there are three contributing factors: (1) ability to recognize the signs of the disease early; (2) willingness to report suspicious symptoms; and (3) promptness on the part of physician or dentist in making a diagnosis and advising or giving adequate treatment.

Unfortunately, up to the present time, three quarters of all cases are hopeless when first seen by the physician.

Pain is rarely present in the begin-

ning, and should not be waited for. In differential diagnosis of cancer, the dentist has practically only two other conditions to consider: syphilis and tuberculosis. Syphilis rarely causes cancer in the mouth, excepting where it may cause chronic irritation. Tuberculosis can be determined by laboratory study, age and history.

I will not burden you with the signs and symptoms of cancer of the mouth and parts adjacent thereto. This you have been taught in your course by professors of pathology and oral surgery. But I shall tell you briefly the early signs of cancer in various regions and how to be on guard to advise patients properly when suspicious signs of the disease are present. The early signs are:

All chronic thickenings and indurations of tissue wherever found.

Any wart, mole or pigmented area occurring on the body, especially if it is changing in form or character, or shows a tendency to become inflamed or crusted.

Any lump or new growth occurring anywhere within or on the body, particularly in the female breast.

Chronically enlarged glands, especially in adults, and more particularly when associated with enlargement or indurated areas.

Any abnormal or irregular discharge or bleeding that may occur from any orifice of the body, including the nipples.

Chronic disturbance of digestion with or without pain, especially if occurring after the age of 40 years.

Difficult swallowing not due to tonsillitis or any other acute infection, especially when persistent and progressive.

Persistent hoarseness not due to acute infection that lasts more than two or three weeks.

Progressive and unexplained loss of weight.

It should not be supposed that when any of the above mentioned conditions are encountered they always indicate cancer; nevertheless, they should always arouse suspicion, and the possessor of them should become sufficiently interested to insist on a thorough investigation for the purpose of explaining their cause and determining their seriousness.

If people knew as much as they should know about cancer, they would seek proper advice on the first appearance of the danger signals. Knowledge of the early symptoms of cancer is life saving only when this knowledge leads to immediate medical consultation, coupled with prompt and efficient action whenever indicated.

5006 Spruce Street.

PRACTICAL LABORATORY METHODS IN ORTHODONTIA*

By ERNEST N. BACH, A.B., D.D.S., Toledo, Ohio

THE laboratory procedures that are to be described, with but few exceptions, are those of other men, and I feel greatly indebted to them for having imparted their knowledge to me. The object of this paper will have been fulfilled if this same knowledge be conveyed to you.

In dealing with the subject of "Practical Laboratory Methods in Orthodontia," it is difficult to say where the work in the operating room ends and the laboratory work begins. For convenience, we will make impression taking the first step for discussion.

Without exception, a plaster impression is the most accurate negative from which a plaster model can be made. The usual procedure consists of making a creamy mix to which has been added a "setter;" greasing the tray, and pressing tray and plaster to place in the mouth, letting the plaster set, removing the tray, and eventually the plaster sections. In addition to this as a time saver in removing plaster, two slots are made in either tray with a fine scroll saw through the total width of the vertical section of the tray in the region of the cuspids. After the tray and plaster are pressed to place, and the plaster has slightly set, a thin piece of cardboard, such as a calling card, greased with "nujol," is inserted in either slot until it touches the teeth and tissues. The cards are removed just before the plaster is hard, and after the plaster is thoroughly set, the tray is removed and the usual anterior portion is easily sectioned out.

For making more definite fractures between the buccal and lingual sections, an inverted v-shaped ridge of tin one eighth of an inch high and one eighth of an inch wide (at the free end) and of a length to include molars and bicuspids is waxed or soldered to the tray, the position being determined by the anterior-posterior line midway between the buccal and lingual cusps of these teeth. After the tray has been removed, a v-shaped groove is left in the plaster close to the occlusal surfaces of the above-mentioned teeth, provided the tray has been pushed properly to place. The fact that the groove is v-shaped instead of knife-edged prevents the crushing of the plaster over the occlusal surfaces when the buccal sections are forced off. These impressions will consist of fewer pieces, making the assembling and separating from the model easier.

Regular compound impressions are very useful in cases of children who are afraid or timid, and in older ones where drag marks would not result. In protrusion cases, the McCoy method proves satisfactory. The anterior por-

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tion of the tray between the cuspids is removed, and compound is placed in the tray and pressed to place, leaving the labial surfaces of the four anterior teeth and adjoining surfaces of the cuspid exposed. The compound is thoroughly chilled and the exposed surface greased with nujol, then more warm compound is pressed over the exposed tooth and gum surface. This is hardened by compressed air. The small section is removed first, and later the remaining compound and tray are removed. The two parts are assembled, waxed together, poured and separated in the usual manner. All compound, if heated over a flame just before insertion in the mouth, will give a more detailed impression.

Models may be made of regular plaster, stone plaster or a combination of stone and plaster. Regular plaster seems adapted for pouring compound impressions, its objection for use in pouring plaster impressions being the ease with which it is broken in separating. Stone plaster for models is successfully used with any impression, its chief objection being the difficulty in trimming the art portion after it sets completely and the length of time required for setting. The material that answers the purpose best for plaster impressions seems to be a combination of stone plaster and regular model plaster. The stone plaster is packed into the anatomic portions and the regular plaster poured on top of the stone plaster forming the art portion. Roughing the surface of the stone plaster makes a better union with the regular plaster. This combination makes the trimming of the model easy after both portions have fully set.

In trimming models, we have been using a combination of two methods, which seems to work out very well. Models are leveled in the usual way and all rough trimming done with an Oliver trimmer, which sets over an open drawer containing a tin recepticle that receives the plaster shavings. After the rough trimming is finished, the fine work is completed with a carpenter's wood plane (one about 8 inches long). A hard wood block 8 inches by 12 inches by 1 inch on which is fastened a smaller hard wood block 4 inches by 12 inches by ¼ inch, leaving half the original block exposed, is used. The model is placed on the thin wood section and the plane, lying on its side with the cutting edge toward the model, is pushed back and forth, trimming the model edges. These are always at right angles to the top and bottom, provided the plane is kept securely on its side when working.

After the models are trimmed and allowed to dry, they may be finished with a glossy coat by making a jar of "ivory" soap suds and washing them in it, and rubbing or drying off with air. The other way consists in rubbing the model with soapstone and a piece of cloth. This process tends to retain the original color of the plaster and shed dust and dirt.

A convenient way of recording models is as follows: Patients are given an even number beginning with two in the order in which they are received in the office. When study models are made from time to time, the same number is used for each model with an exponent one, two, etc., denoting the number of models taken since the original. When the case is completed, the finished model bears the next highest odd number. The name and age of the patient and date of the impressions are

recorded on the back of the lower model, and all lettering is done in India ink. The models are arranged numerically in cabinets.

A discussion on the making of appliances could cover many pages, but only a few points which seem to bear particular relation to the subject will be here considered.

After bands are made, either directly or indirectly, a good compound or plaster impression is taken with the bands on the teeth. These bands are removed and inserted directly in their impressions in the impression material. Staple shaped pieces of wire are inserted in individual tooth impressions for strengthening the teeth in the plaster model and especially the ones that are banded. This applies particularly to anterior teeth when attachments are soldered to the bands as the plaster becomes very brittle and porous. Regular plaster is satisfactory for soldering upon, although various stone plasters are used by many. Stone plasters allow a more complete contouring of the occlusal edge of the molar bands when malleted.

Dr. Porter describes a splendid method of making models for rapid work when an appliance has to be made immediately. To a quarter of a bowl of very warm water, from one-half to three-fourths teaspoonful of salt or potassium sulphate is added and the plaster is stirred in very quickly. One must work rapidly to insert this into the impression before it sets. The model will be ready for separation by the time the bowl is cleaned and the materials are put away. If compound is used, it is heated over a flame to soften and is then removed. The operator does not wet either plaster or compound impressions to separate them, and thus the model will be dry to solder on.

By use of a Blue Island soldering stand, the model is clamped to the rotating table and the desired attachments are soldered to the molar bands. The cusps of the banded molars are trimmed flush with the occlusal edge of the bands and a piece of match stick or other wood is clamped on top of each band; this preventing the band from being displaced when the labial and lingual wires are adapted and inserted in the tubes.

A convenient way of holding tubes that are being soldered to bands is to use a steel needle that has been driven into an orangewood stick. The needle should be but slightly smaller than the tube. For vertical tubes, the free end of the needle is bent while red hot, at a right angle, the distance from the end being equal to the length of the tube used. The tube is placed on this and held against the band on which solder has previously been placed, and soldered there. Steel is used, as solder adheres with difficulty to it. "Anti-flux" also will prevent undesired soldered joints. Whenever tubes and connections are to be soldered to bands, a small amount of solder is melted on the spot, which leaves both hands free when soldering, one to hold the attachment, and the other, the blowpipe. Solder is used in wire form. When very small amounts of solder are desired, the size is from 26 to 28 gage, and when larger amounts are needed, 21 or 22 gage is more desirable. This is purchased in a coil and the whole coil fluxed with soldering flux and dried with the flame, which saves fluxing each time a joint is to be made. Mellotte's blowpipe proves very satisfactory for soldering as

a small pencil flame is obtainable. All stabilizing wires are bent with heat, the labial being very easy to bend. The wire is placed in the tube on the left side and heated with a brush flame and gently bent while hot. The wire is liable to break if too much pressure is used and not enough heat. A pointed flame is used where a sharper bend is desired. Lingual arches may be adapted in a similar way, although a general adaptation by hand first, later using heat and a slate pencil to adapt accurately, has proved more satisfactory.

The following items, although not topics for discussion, are worthy of note. Appliances are easily cleaned by boiling in hydrochloric acid in a porcelain crucible. Dr. Barnes has a neat way of preventing the spattering of acid when heated appliances are placed in it. He uses a large round glass jar 6 or 7 inches in diameter and 2 or 3 inches deep, which contains a solution of sodium bicarbonate, and inside this is a smaller jar, yet large enough to receive an assembled appliance, which contains the acid. The larger jar serves two purposes, neutralizing both action of the acid on the appliance when it is dipped in it, and the undesired action of the acid on the surrounding material. A cover glass fits the larger jar.

Round wire is difficult to handle with flat nosed pliers, but if these are grooved in two directions, parallel with and at right angles to the long axis of the handles, the difficulty is greatly overcome. The grooves can be made with an iron drill not larger than 23 gage.

The grooving of soldering tweezers is also worth the effort. Small spring wire can be held quite securely with this tweezer.

A fine mesh, brass wire gauze serves a good purpose when so arranged over the end of a blowpipe which is lighted but not in use. The gauze distributes the heat without becoming excessively hot itself and may save many burns.

Another little convenience may be found in the use of an air and gas regulator for the blowpipe and burner. On either the gas or air outlets, two valves are placed between the outlet and the blowpipe or burner. The one nearest the burner is set to give the desired air pressure and is left in this position, and the other is used for a shutoff only. This saves regulating air pressure each time the burner is used.

The top of the cabinet on which soldering is done is covered with Johns-Manville asbestos composition material. This is one-fourth inch thick, hard and heat resisting and is black. This dark surface enables one to see the small cone of the blowpipe and burner.

Each of these topics which have been mentioned or discussed has been of help to me and I hope may prove of benefit to others.

CYSTS OF THE MAXILLAE AND MANDIBLE*

By LOUIS SCHULTZ, D.D.S., M.D., Chicago, Illinois

CLASSIFICATION

IN classifying the epithelium lined and fluid filled pathologic cavities in the jaws, called cysts, I shall consider the rate of incidence in their enumeration, giving the most rare first and ending with the most frequent. Probably, the variety which occurs least often is the one known as hydrops antri, or cyst of the maxillary sinus, or occlusion of the ostium maxillare. The next rarest variety has many names and many compartments. I refer to multilocular cyst or epithelial odontoma, also known as fibrocystic disease of the jaw, cystoma, multilocular cystic epithelial odontoma, adamantinoma polycysticum or epithelioma adamantinum cysticum. Next in frequency comes the follicular odontoma or dentigerous cyst or coronodental cyst, while by far the most frequent is the dental cyst, root cyst or inflammation cyst.

Hydrops Antri.—This cyst is said to be due to cystic degeneration of some of the mucous glands of the maxillary sinus which results in a marked distention of that cavity. It is filled with a glairy, mucoid fluid. It is also said to occur from the encroachment of a root cyst filling the maxillary sinus; but this still would result in a dental cyst. I realize that a recurrent root cyst due to incomplete eradication of the epithelial lining when the guilty tooth is extracted may entirely fill the maxillary sinus, so that it may not be differentiated from a case of cystic degeneration first mentioned, but in all cases in which the guilty tooth remains *in situ*, differentiation should not be difficult.

Multilocular Cysts.—These cysts occur in young adults and are derived from the enamel organ. They consist of spaces lined with cuboidal epithelium and their origin and structure are responsible for the multiplicity of names applied to them.

Follicular Odontomas.—These have been so named by Bland-Sutton in his classification, but, although they occur in connection with a tooth, they are cysts in the sense that they consist usually of a more or less large epithelium-lined cavity filled with cystic fluid. They arise from a misplaced tooth anlage, and the epithelium lined cavity represents a distended tooth follicle. Also, in contradistinction to the fourth variety, the crown of the tooth lies within the cyst cavity, while in root cysts the root apex is usually found within it.

Root Cysts.—These cysts are of most frequent occurrence. They are caused by irritation due to a low-grade infection within the root canal of the offending tooth. This irritation, be it from toxins or bacteria, causes sufficient stim-

*From the Department of Oral Surgery, University of Illinois.

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ulation of the cells in the periapical region to provoke mitosis. The presence in that area of some remnant of the enamel organ or of Malassez's epithelial débris furnishes the epithelial lining. Root cysts may occur on teeth containing vital pulps, but this variety is much more rare than the kind just described. I have had a few cases in practice. They probably originate in a manner similar to that of lateral abscesses occurring on teeth with vital pulps. The latter were first described and named by the late G. V. Black. In the lateral abscess, the hematogenous pus infection is virulent enough to produce an abscess; in the root cyst, it is probably just sufficient to cause mitosis. Localization of the irritant must be at the seat of Malassez's epithelial débris to produce a cyst.

DIAGNOSIS

Hydrops Antri.—These cysts may be diagnosed by absence of pain on distention of the walls of the sinus, absence of inflammation, negative findings by both transillumination and roentgenographic examination and the absence of a unilateral nasal discharge. If the condition has progressed far enough, there may be displacement of the nose and the eye, and palpation of the distended area may elicit a crackling as of parchment or even fluctuation. Aspiration will yield the fluid described under classification.

Multilocular Cysts.—A complete case history is of great value in the diagnosis of this rare condition. It is the result of a stimulation of epithelial cell rests, derived from the enamel organ, causing mitosis. Dental diseases or trauma may furnish such a stimulus, or any occupation which involves contact with phosphorus, lead or mercury. A history of very slow development with pain at the beginning is suggestive. The absence of teeth or a crowded condition of the teeth may be of value in diagnosis. There is most frequently a slow distension of the walls if the cyst forms in the mandible. The overlying tissues are usually movable. Transillumination may be of help. Palpation may elicit crackling if sufficient absorption of bone has taken place. A good roentgenogram usually shows the true condition present.

Dentigerous Cysts.—These are far more frequent in occurrence, usually appearing in the mouths of young people, and may be suspected when there is absence of a permanent tooth with a history of no extraction. A roentgenogram will reveal a radiolucent, rather sharply defined area and may show the crown of the responsible tooth within the cavity. A dentigerous cyst usually occurs in the mandible, which may be distended if the lesion is not detected early, and on palpation, there are the usual findings of crepitation or even fluctuation. Aspiration will yield the characteristic cystic fluid. If these cysts become secondarily infected, they present a sinus, discharging offensive pus.

Root Cysts.—These are the most common type of cysts found in either upper or lower jaw. They are painless and usually related to a pulpless tooth containing a root canal filling or an infected root canal. The roentgenogram shows a definitely demarcated radiolucent area, surrounded by a thin layer of dense bone, the result of pressure exercised on the surrounding bone by the expanding membrane, causing pressure atrophy. Crackling or fluctuation may occur. Aspiration yields the characteristic clear, straw-colored viscid

fluid containing highly refractile cholesterin crystals. Secondary infection causes a reaction similar to that described under dentigerous cysts. A root cyst occurring on a tooth in close relation to the maxillary sinus may invade the latter cavity and partially or wholly fill it. Extraction of the offending tooth without total eradication of the cyst does not result in a cure. A so-called bone cyst usually follows; in reality, the sequel of inefficient treatment of the first condition.

TREATMENT

Hydrops Antri.—The usual treatment consists in the Kuester operation, opening the sinus through the canine fossa, removing the membrane, packing and irrigating until the walls have become healthy, when one may let the opening heal. I believe that a better treatment consists in a simple ventilation of the sinus under the inferior turbinate, either according to Vail's or Stein's or any intranasal method. If this is accompanied by liberating a flap from the under surface of the inferior turbinate, and, after the external nasal wall in that area has been removed, placing the flap through the opening and on a previously prepared field in the sinus, such ventilation will be permanent, the patient quickly becomes symptomless and the postoperative treatment is considerably shortened. If, on entering the sinus by Kuester's method, it is found that a root cyst is partially filling it, the offending tooth having been lost at a previous period without treatment or with inefficient treatment of the cyst, an excision of the cyst wall between the cyst proper and the maxillary sinus, followed by immediate closure of the opening in the canine fossa, will quickly give relief and leave the patient in a condition more nearly approximating the normal than if a more elaborate course be followed.

Multilocular Cysts.—The entire tumor mass, including the main cyst wall, must be removed. The bone walls should be curetted to destroy any remaining cystic cells, and the cavity should be packed and repacked, and should be allowed to heal from the bottom of the wound.

Dentigerous Cysts.—Treatment calls for a total ablation of the cyst wall, and usually the extraction of the tooth. A distended jaw may be molded to assume

Fig. 1.—Anterior portion of root cyst and molar causing cyst.

normal shape. The cavity should be packed, irrigated and allowed to heal from the bottom. If it is small and no epithelial cells remain, I close it at once to obtain healing by first intention, if possible.

Root Cysts.—A thorough, complete eradication of all epithelial cells lining the cavity is essential, for, if any epithelial tissue remains, a recurrence must be expected. The offending root may be resected under proper conditions and the cyst eradicated as described above, when this is indicated. The Partsch operation should be mentioned in this connection. In my opinion, this is the ideal treatment of retention cysts and other cysts of the soft tissues.

Complete eradication of all epithelial elements in the cyst cavity is rendered unnecessary. In bone cysts, a flap is made from the soft tissues covering the cyst, the underlying bony wall removed and enough epithelium curetted away to permit the flap to rest directly on the fibrous capsule. All overhanging wall must be cut away. The flap is then placed on the prepared area and secured by a suture, and the mucosa surrounding the balance of the opening is sewed to the cyst lining. Thus, the cystic cavity becomes a part of the oral cavity, the cystic lining changes, and very slowly there is a partial filling of the former cyst cavity since the pressure within has been removed. However, the normal topography of the surface is not restored, and this, with the protracted convalescence, causes me generally to give preference to some other method.

The popular method of eradicating cysts is by entering the cavity and removing the membrane or at least the epithelial lining by means of the curet. The result is sometimes not perfect, some epithelium remaining and proliferating. This necessitates a further attempt at its destruction by chemical cauterizing agents and mechanical means, such as a second curettage or removing the cells with gauze packs, etc.

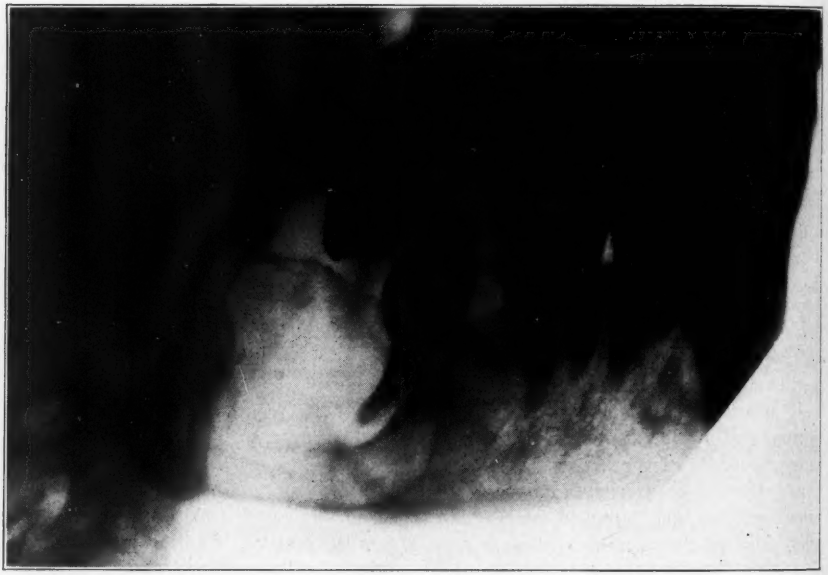

Fig. 2.—Entire cyst, showing attachment of molar to bone and involvement of mandible.

It is my practice to try in both dentigerous cysts and root cysts to remove the cyst membrane by means of periosteal elevators rather than with the curet. Small cavities I close at once, in order to get union by first intention, thus shortening the postopera-

tive treatment to about one week. When successful, this operation insures absolutely against recurrence, while curettage is less satisfactory. If these cavities occur near the maxillary sinus or the floor of the nose, care should be taken not to enter these cavities. Similar precautions should be taken when absorption of the lingual plate of the jaw has occurred in order not to penetrate the gum or injure the periosteum.

Fig. 3.—Appearance of patient, showing slight enlargement of left mandibular region at angle.

To illustrate what may be accomplished by such removal *en masse* of root cysts, I here report a case from my practice.

REPORT OF CASE

History.—Mrs. M. T. H., aged 26, referred to me last November, gave a negative family and personal history. About two and a half years previously, she had had the lower left second molar filled. Two weeks later, she developed a pericementitis, lasting about six weeks. This was followed, in from four to five months, by intermittent shooting pains to the head and ear, which persisted to the time of operation. Two weeks before she was referred to me, she had a full set of dental roentgenograms made preparatory to having her teeth put in order. The film of the left lower molar region disclosed the anterior portion of a large radiolucent area (Fig. 1), and a plate made of the left half

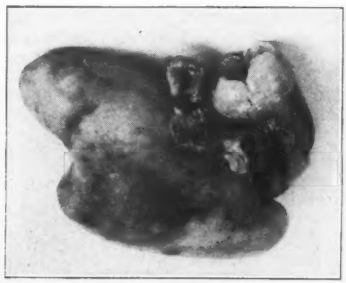

Fig. 4.—Cyst with tooth attached; showing two projections caused by mandibular foramen.

of the mandible (Fig. 2) showed this area extending from the second molar backward, including the entire body at the angle, leaving but a shell of the cortex and going up into the ramus, where it was lost in the overlying bony structures. This area of bone rarefaction had a definite, clear-cut outline surrounded by dense bone. Both plate and small film show areas where practically all

Fig. 5.—Cyst, showing groove made in wall by inferior alveolar vessels and nerve.

the bony structure is gone. The first and third molars were missing. The filling in the remaining molar included the pulp chamber, but the root canals appeared empty; at

least, no radiopaque substance was to be seen in them.

Examination.—The patient was a well nourished woman with small features, showing a slight swelling in the left mandibular region at the angle of the lower jaw. (Fig. 3.) Inspection and palpation revealed quite an enlargement of the left mandible

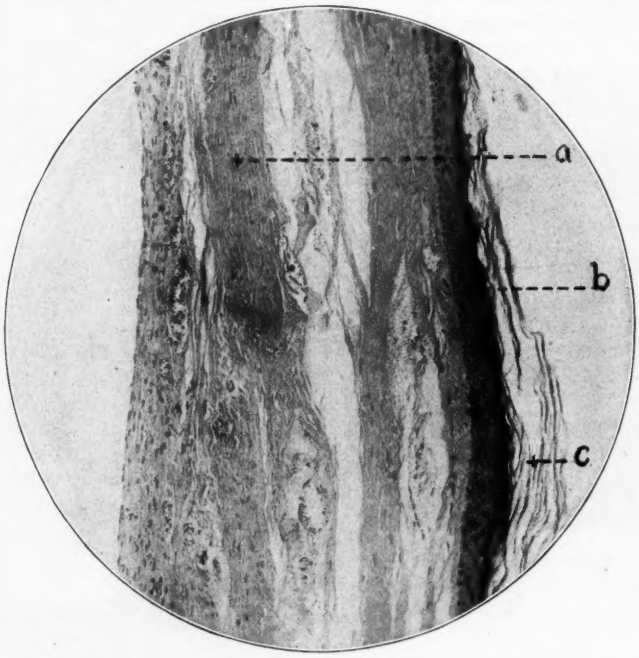

Fig. 6.—Section of cyst. *a*, connective tissue wall containing many thin-walled blood vessels; *b*, thick epithelial lining; *c*, horny layer. (× 85.)

corresponding to the radiolucent area in the roentgenogram. Intraorally, crackling as of parchment could easily be elicited, especially near the alveolar ridge between the molar tooth and the ramus. That part of the body was quite distended.

Diagnosis.—Root cyst caused by a diseased molar tooth was diagnosed.

Operation.—Nov. 7, 1925: Local anesthesia (conductive type) was employed. An incision was made along the alveolar crest from the retromolar fossa to the molar. With a periosteal elevator, the soft tissues, including the periosteum, were separated from the bone, the gums all around the molar tooth being included. Several spots where bone was completely absorbed were found, through one of which I started the dissection of the underlying cyst membrane from its bony covering. The periosteal elevator separated the thin shell of bone forming the alveolar crest without difficulty, enabling me to dislodge the sac from the bone on both buccal and lingual surfaces. Far greater difficulty attended the peeling off of the membrane in the ramus, for the sac extended beyond the mandibular foramen in the form of two digits, as the picture of the cyst clearly shows. (Fig. 4.) In dealing with the anterior part of the sac containing the apical portion of the roots of the molar within it, I partially separated the coronal portion of the root at-

tached to the jaw from the latter with a bur driven by the dental engine, and completed the separation by careful wedging. Very little force caused the weakened jaw to bend; and this served as an index to the amount of power I dared apply. By careful and deliberate manipulation, I finally succeeded, the tooth was detached from its socket without course by the expanding sac. These structures were not injured in the operation, sensation in the lip returning in about a month. The teeth also lost the feeling of paresthesia, all being normal at this time. I inserted a drain, closing most of the opening with two catgut sutures. November 9, I removed the drain. The wound was kept clean by irriga-

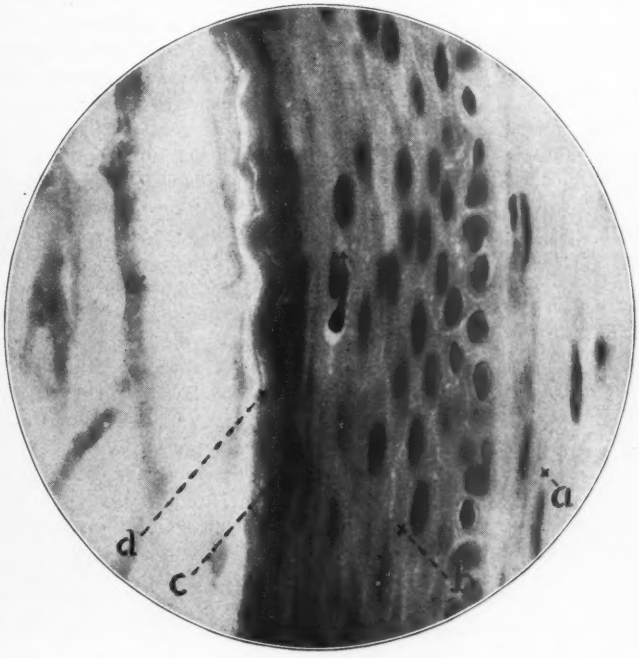

Fig. 7.—Section of cyst. *a*, connective tissue of wall proper; *b*, epithelial cells with intercellular bridges; *c*, cells containing keratohyaline granules; *d*, horny layer. (× 750.)

severing its relation with the cyst, and the lower portion of the sac was peeled off. Freeing the two digits in the ramus enabled me to deliver the entire sac with the molar attached. (Fig. 5.) The sac showed a definite groove running from the sulcus between the two digits—the site of the mandibular foramen—forward across its buccal surface along its inferior margin, until it was lost near the molar tooth. This groove was caused by the inferior alveolar vessels and nerve, which were pushed out of their normal

tions with iodosaline solution. The patient made an uneventful recovery.

Pathologic Findings.—(Fig. 6.) The wall of the cyst was thin and the outer and inner surfaces were quite smooth.

Microscopically, the wall proper consisted of connective tissue which was more fibrous in the larger portion of its width and richly cellular in the smaller outer zone. Throughout the wall, this connective tissue was well supplied with small thin-walled blood vessels, and the interstices were filled with blood,

especially in the outer cellular zone. The cyst wall was lined with squamous epithelium. This epithelial lining presented some interesting features. Unlike other large cysts in which the epithelial lining is reduced to one or two rows or even shreds of more or less compressed epithelial cells, the original character of which is sometimes beyond recognition, this cyst had a thick layer of distinct squamous epithelium, and this was practically a reproduction of the epidermis. There were no papillae. The epithelium formed a uniform straight layer over the connective tissue wall. Also, a basement membrane was lacking. Otherwise, there were all the constituents of the epidermis. (Fig. 7.) The first layer consisted of cells with a large, round, darkly staining nucleus. The cells lying above this basal layer were typical prickle cells; the intercellular bridges and spaces were quite distinct. Overlying this structure was a granular layer showing flattened cells with an indistinct nucleus and coarse granules, the keratohyaline granules, within the protoplasmic cell body. This layer was dark from the presence of these granules. Outside this stratum granulosum, a layer of horny masses was found, which, with the Van Gieson stain, showed the characteristic yellow of horny tissue.

COMMENT

The presence of cells containing keratohyaline granules and the process of cornification in cysts is an unusual feature which I have not yet observed. Cornification does not normally occur in the mucous membrane of the mouth; it is a pathologic occurrence which is most pronounced in leukoplakia, but is also observed in various other pathologic conditions and in tumors, when the projecting free surface is subjected to some chronic irritation, chronic pressure, etc. In the case of this cyst, it is difficult to conceive of any chronic irritation within the cystic cavity. We may perhaps rather assume that the epithelium, having all the morphologic characteristics of the cutaneous epithelium, also was endowed with the characteristic functional properties of the epidermis. This similarity of the epithelium lining the cyst to the squamous epithelium of the skin can well be understood when we remember that the mucous membrane of the mouth is simply an invagination of the skin of the face, and while it becomes modified in its adjustment to the functional requirements of mucous membranes, it retains the properties of the parental tissue potentially. This holds true even of the oral epithelium that undergoes further modification; namely, the differentiation into the enamel organ. Although in some cases cysts derive their epithelial lining from proliferated surface epithelium, the majority of root granulomas and root cysts owe their epithelium to proliferation of Malassez's epithelial débris, i.e., remnants of the epithelial root sheath, which is a prolongation of the outer epithelial layer of the enamel organ. Cells of remnants, of whatever part of the enamel organ or ridge, are perfectly capable, morphologically and functionally, of a reversion to the original type of tissue. In fact, the epithelium of root granulomas and root cysts invariably shows the return to the epithelium of the mucous membrane, and even adamantinomas, in which the origin of the tumor cells from the enamel organ, as a rule, is clearly seen, generally contain regions in which the epithelium distinctly assumes the appearance of squamous epithelial cells.

The unusual points of this case are (1) that I was to remove cyst and tooth *en masse*, especially since it involved so much of the ramus; (2) that I succeeded in dislodging the tooth from its socket without disturbing its anatomic relation with the sac, and (3) that the operation was finished without causing fracture of the weakened jaw.

CYSTS OF THE MAXILLA AND MANDIBLE*

By HERBERT A. POTTS, M.D., Chicago, Illinois

SCULTATUS was the first to describe cysts of the jaw, in 1654, and Fouchard was the first to connect these cysts with the teeth. Paget,[1] in 1853, gave us the term "dentigerous cysts," and Broca[2] first pointed out that developmental disturbance of the tooth follicle may lead to cyst formation.

Magitot[3] stated: "Every spontaneous cyst of the jaw is essentially and exclusively of dental origin," and he made a definite distinction between cysts arising from the tooth follicle and those which arise from the epithelium of the peridental membrane, which he called *kyste periostique* (root cysts). Cysts identical with root cysts, which usually occur in conjunction with pulpless teeth, are not infrequently seen near the apices of permanent teeth whose pulps are

Fig. 1.—Cyst developing between the apices of upper central incisors in a patient, aged 20 years. The pulps are alive, apices eroded. There were no symptoms.

Fig. 2.—Cyst between the lower right bicuspids, in a patient, aged 22 years. The divergence of the roots may be noted. The pulps are alive, and there were no symptoms.

*Read before the Section on Maxillofacial Surgery and Surgical Prosthesis at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 25, 1926.

1. Paget, James: Lectures, Vol. 2, p. 90, 1853.

2. Broca, Paul: Treatise on Tumors, Vol. 2, p. 55, 1869.

3. Magitot, Emile: Cysts of the Lower Jaw, Bull. et mém de la soc. de chir. de Paris, p. 410, 1878.

Fig. 3.—Cyst below the lower right first molar in a patient, aged 21 years. These pulps are alive, and there were no symptoms.

alive, as shown by the accompanying illustrations.

These cysts were found at as early as 14 and as late as 35 years of age. One case here shown occurred five years after the removal of an unerupted cuspid. I have often wondered whether a cyst might not develop from the remains of the enamel organ which I have left after the removal of an impacted or unerupted third molar.

With the exception of the presence of a fully or partially formed tooth

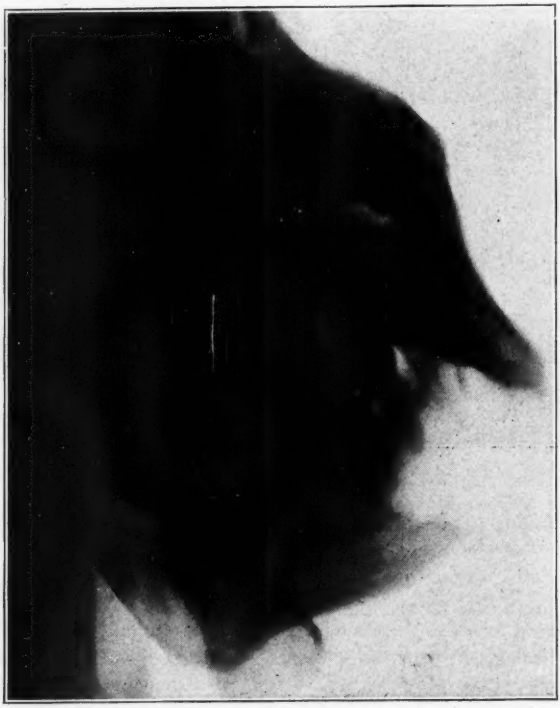

Fig. 4.—Cyst extending from below the mesial root of the lower left first molar to the left central incisor, with the lower border of bone decalcified in a patient, aged 35 years. The pulps are alive. There are no symptoms. Operation was performed, Jan. 17, 1926. There has been no recent roentgen-ray examination, but the cavity is one-third its former size.

within the follicular cyst, the contents of the follicular cyst and the root cyst, as well as their microscopic pictures, are similar. Whether these cysts really arise from the epithelium of the enamel organ or from the epithelium of the peridental membrane or from epithelial rests of the dental lamina is of minor consideration and well nigh impossible to prove, but the treatment of them is of paramount importance. The oral mucous membrane gives rise to the dental lamina which dips down to form the enamel organ and matrix of the teeth, both temporary and permanent. These cells undergo an extensive and diversified metamorphosis. The converse is also true when these cysts are made into accessory oral cavities in that the fluid-secreting cells soon assume the character of the cells which make up the oral mucous membrane. The cells lining the follicular cyst will take on the same properties, and these cysts may be treated in the same manner, the

Fig. 5.—Cyst extending from the distal root of the lower right third molar to the right first bicuspid, in a patient, aged 38 years. The pulps are all alive, and there were no symptoms. At operation, the apices of the teeth were seen projecting into the cyst cavity, but were covered by the cyst wall. This cyst contained a pultaceous mass, which was carefully washed out. The microscope revealed epithelial débris, fat droplets and cholesterin crystals. Eight months later, there is almost complete regeneration of bone. There remains an almond kernel-sized cavity, which will be curetted out soon if it does not fill in.

In a case not illustrated, a dentigerous cyst involving the whole ramus was enucleated together with the first and second molars and the malposed third molar near the angle. The recovery was long and tedious. This was done ten years ago before the great advantage of the Partsch method, which could have saved the first and second molar teeth, was realized.

Fig. 6.—Case in which a previous attempt had been made to remove the tooth and the cyst was infected, with all the signs and symptoms which accompany such an infection. After the acute stage was passed, drainage being established, the tooth and cyst were removed. The second molar was sacrificed at the time of operation.

malformed or malposed tooth being extracted through the opening made into the cystic cavity, care being taken that the lining membrane be not elevated from the bony wall.

One should distinguish between the true dentigerous cyst into whose cavity the crown of the tooth projects and the one whose crown is simply surrounded

Fig. 7.—The case shown in Figure 8, ten months later.

by the cyst wall but does not project into the free cavity.

The multilocular cyst and the adamantinoma are undoubtedly of enamel-organ origin, as suggested by Malassez[4] and others,[5] but, because of their proclivity to recur, must be radically excised; even an exarticulation may be necessary to prevent a recurrence. As the most important part of our work is

Fig. 8.—Cyst extending from the right central incisor to the second bicuspid. The pulps were all alive with the exception of the one in the lateral incisor. This root will be filled and the apex resected. The lower picture shows how complete has been the regeneration of bone.

Fig. 9.—Cyst extending from the left second bicuspid to the right central incisor. As the patient is in good health and 35 years of age, it will be determined after the bone has regenerated how many and what teeth should be extracted. The extraction of any of the teeth at this time would mean loss of the external plate, with great deformity.

4. Malassez, L. C.: Note on the Development of Disease of the Jaw, Cong. franc. de chir., second session, 1886.

5. Galippe: Epithelial Débris, 1910. Bump, Walter S.: Adamantine Epithelioma, Surg. Gynec. & Obstet., to be published.

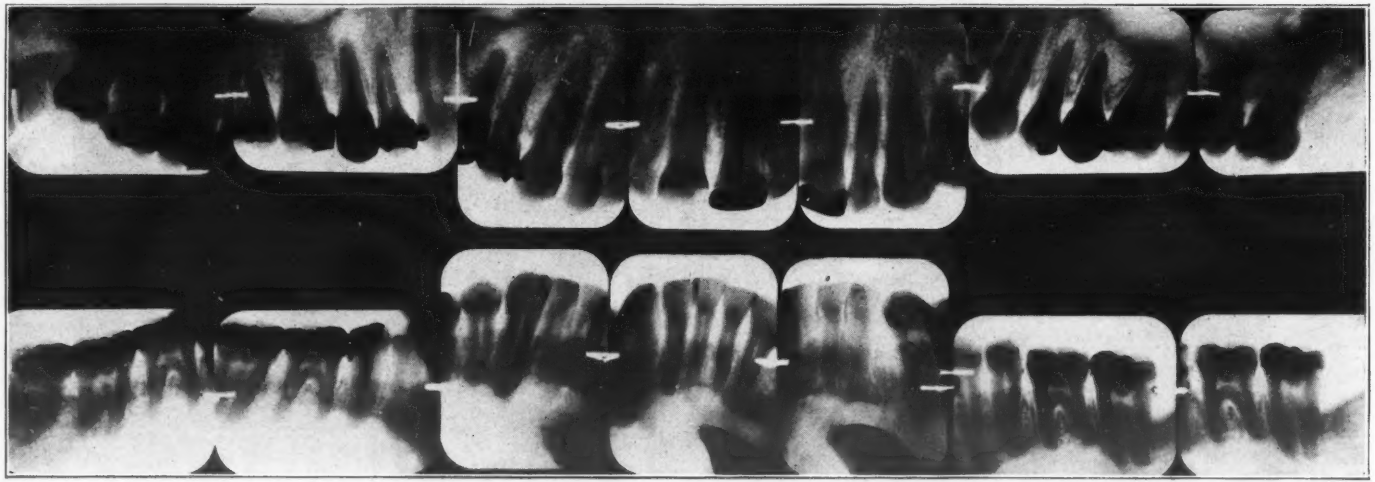

Fig. 10.—Two extensive cysts, only partially depicted, extending from beyond the third molar of either side to the site of the lower right cuspid, which is unerupted and lies in the only solid portion of bone to be found in the body, the entire lower border of the body being only a partially and decalcified shell. For reasons of safety, the cuspid will not be taken out until later. Only the cyst of the left side was operated on. The right side will be operated on after a lapse of three months from the first operation. The pulps of all lower teeth are vital, with the exception of the lower left second bicuspid, which has a perfect root filling. These extensive cysts produced no symptoms. The only sign was increase in size of the bone.

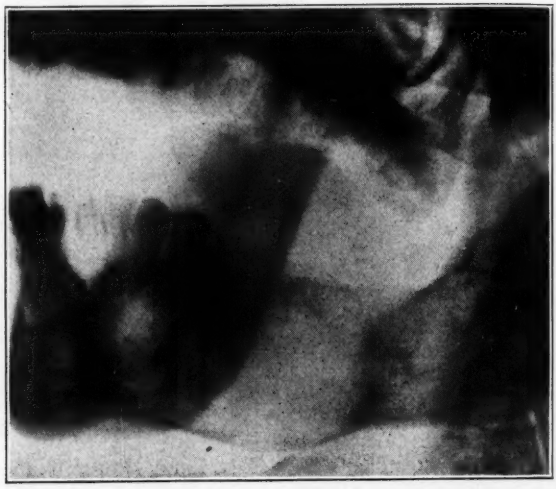

Fig. 11. — Another double cyst, which at operation was converted into one cavity, extending from the posterior border of the ascending ramus to the lateral region on the right side.

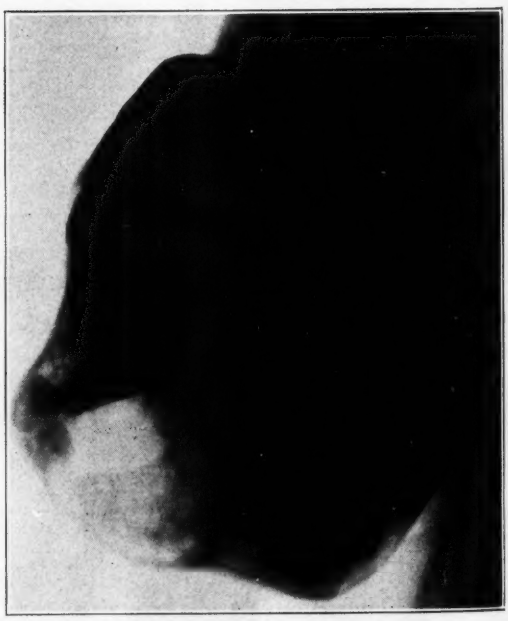

Fig. 12. — Complete bony regeneration occurring within seven months. The tooth in the mental region at the lower border of the bone may be noted. On account of the patient's fear of operations, only the third molar was extracted. There was no other operation. A roentgenogram taken one year later shows that complete regeneration had occurred spontaneously.

the preservation of organs and tissues commensurate with the restoration of the patient's health, let us consider the method best suited to the treatment of the great majority of cysts (the multilocular cyst excluded).

Many large cysts have so far eroded the bone that the apices of any number of teeth are void of bone, but rarely do

Fig. 13.—Cyst formed five years after an unerupted lower right cuspid had been taken out, possibly from part of the enamel organ left at the time of the removal of the tooth. There was no cyst present at that time.

they penetrate the cyst. The pulps of most such teeth are alive, and it is important that they remain so and that the teeth themselves be retained. If the cyst wall is removed, either piecemeal or by dissection *in toto*, the nerves and blood vessels entering the apices of the teeth must necessarily be destroyed.

In the edentulous mouth, it is necessary to preserve the alveolar ridge even though it is a shell of decalcified bone, which not infrequently is collapsed or flattened by usual methods of procedure.

Malassez's conclusion that root cysts spring from epithelial rests seems most satisfactory. It implies that the epithelial cells found normally in young peridental membrane are epithelial rests, which is further proved by their disappearance as the individual grows older.

The manner in which most cysts larger than a small cherry are treated precludes the possibility of saving the pulps of the teeth whose bony attachments have been destroyed by the encroachment of the cyst wall. In fact, if the teeth whose roots apparently puncture the cyst are extracted, many times the remains of the process which makes up the ridge is also lost. This procedure facilitates the removal of the cysts, but valuable teeth have been lost, and the bony deformity caused by the loss of the process impairs the usefulness of an artificial denture.

In the upper jaw, more serious difficulty arises in that the cyst may and frequently does encroach on the antrum. The bony wall of the antrum is absorbed by the pressure exerted by the cyst, and the antral mucous membrane is collapsed, the cyst itself occupying the normal antral site. This results in the condition formerly called "hydrops of the antrum," a misnomer because the fluid is not in the antrum and no fluid passes from the cavity into the nose by way of the normal opening.

The removal of the cyst wall can hardly be accomplished in such a case without opening the antrum, which

Fig. 14.—An adamantinoma, a soft tissue tumor with a broken-down center, which was as thoroughly curetted as possible. As it had been operated on twice before, its nature was suspected, but as the patient was a good looking young woman of 26 years, it was decided not to perform the mutilating operation of resection and disarticulation. (Compare Fig. 19.)

Fig. 15.—Case in which there has been no regeneration of bone; in fact, there are indications of the development of a multilocular cyst. According to Malassez, these cysts spring from the same source—the enamel organ.

complicates the procedure and prolongs the patient's illness; with the release of the pressure within the cyst, the jaw

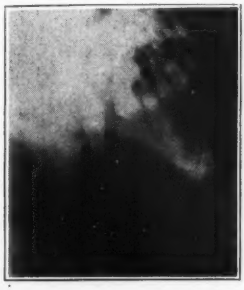

Fig. 16.—A multilocular cyst, which was removed by resection of ramus and body. Two weeks later, the patient developed pneumonia, to which he succumbed.

bones show a remarkable tendency to return to their former size and shape and the collapsed antral mucous membrane will become inflated. The operation first suggested by Dupuytren[6] in 1839, but improved on and advocated

Fig. 17.—Cast showing almost complete healing out of cyst.

by Partsch[7] in 1892, releases the contents of the cyst; the patient is well within a week or ten days, and, within a few months, the bones and soft tissues have returned almost to their normal condition.

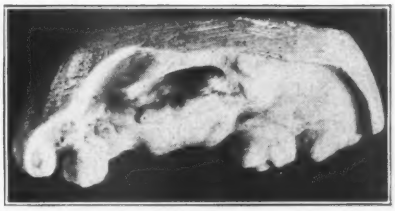

Fig. 18.—Cast showing almost complete healing out of cyst.

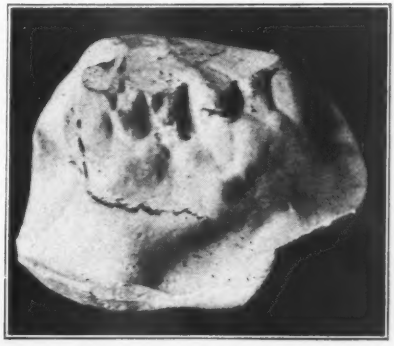

Fig. 19.—Cast showing almost complete healing out of cyst.

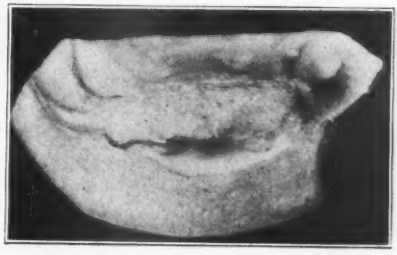

Fig. 20.—Cast showing almost complete healing out of cyst.

6. Dupuytren, Guillaume: Maxillary Cysts, Paris, Ed. 2, Vol. 2, p. 129, 1839.

7. Partsch: Cysts of the Jaws, Deutsch Monatschr. f. Zahnhlk., No. 7, 1892.

The technic, which is simple but rather delicate, consists of an incision, usually near the sulcus, so made that the mucous membrane can be sutured to the incised cyst wall. The incision is carried through the periosteum, which is reflected; and the bone, which is in many cases decalcified, is cut away with bur, chisel or punch, care being taken not to rupture the cyst. The cyst wall is then incised to the full length of the mucous membrane incision and, after irrigation of the cystic contents, the edges of the cyst wall and the mucous membrane are sutured together, leaving a large opening. The opening, not the cyst, may be packed for a few days to maintain its size. An uneventful recovery usually follows. The patient simply syringes out the food which collects in the cavity during meal time. The epithelial lining which arose from the oral mucous membrane assumes the character of it, and as bone is built in, the cavity becomes smaller, until finally there is only a slight depression at its site. (Perthes.[8])

The Figures 1-20 show some cases illustrating what I have endeavored to emphasize in the paper.

8. Perthes, G.: Wounds and Diseases of the Jaws, Stuttgart, 1907.

METHODS TO INCREASE THE ADHESION OF DENTURES*

By PROF. KARL HEITMULLER, Gottingen, Germany

IN the last thirty years, more than thirty patents have been granted on devices to increase the adhesion of dental plates. Though most of them have only historical interest, we see how much the dentists have been interested in this matter and how important it is.

Such auxiliary appliances can be used almost exclusively for upper dentures because the lower jaw, where the dental plate rests, generally is too narrow for them.

In well-healed, not too flat upper jaws when the bite is normally formed, generally especial means to increase the adhesion of dental plates are not necessary, though upper whole dentures will be moved a little in mastication, in which, of course, there is some danger that air and food may get below the denture and cause it to separate from the gum. This accident cannot be avoided even by the so-called functional impression.

To increase the adhesion of the upper whole dentures, it has been recommended that a little be scraped from the upper impression in the hard middle part of the palate and a little wax or tinfoil put on the impression, just where the gum tissue is rather soft at both sides of the middle line.

Many dentists use suction lines (elevations on the gum side of the denture) about 0.5 mm. high to increase the adhesion of dental plates in order to prevent getting air and food under the plate. These lines will be best placed in a half circle inside the alveolar ridge, extending to another suction line near the posterior rim of the plate up to the alveolar process. It is not advisable to make this line on the exterior part of the ridge because this line, in mastication, is liable to hurt the tissue. The line should be omitted where the palate is hard, and should be made higher where the tissue is soft. Naturally, suction lines cannot be used in swaged plates. Some dentists object to the use of adhering lines. I quote the words of Charles Essig, late teacher in mechanical dentistry at the University of Pennsylvania: "This bead (suction-line) is of a special value in cases in which no chamber is used, and in connection with the chamber it greatly increases the amount of atmospheric adhesion."

Then there are several cases in which we need better means to increase the adhesion of upper whole dentures, using the atmospheric pressure in addition to adhesion. Such cases are found in (1) protrusion of the lower jaw; (2) a lower jaw with natural teeth much

*Read before the Section on Full Denture Prothesis at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 24, 1926.

broader than the upper jaw; (3) a flat and hard upper jaw; (4) spongy tissue of the alveolar process; a small perforation of the palate; (5) extracted teeth with the jaw not healed; (6) artificial front teeth ground directly to the gum; (7) instances in which persons force the air out of the mouth, e. g., glass-blowers and musicians using wind-instruments, and persons having a severe cough, and (8) patients who, even under normal conditions, cannot get accustomed to a full denture.

In such cases, many dentists use vacuum chambers in the palate part of the denture either in simple forms or in the form of vacuum chambers consisting of a great number of little cups, using patterns of tin or perforated metal plates. If the air is partially exhausted from the chamber by sucking, the atmosphere will press against the lingual surface of the plate and cause it to adhere better to the gum. At first, such chambers will increase the hold of dentures, but after some months, the corresponding gum tissue becomes hypertrophic and will fill up these chambers, and they cease to be. In addition, during the movement of the dental plate by mastication, especially in the named cases, a little air may get into the chamber and the plate will drop down. To avoid the growing of the gum tissue into the vacuum chamber, some dentists used a perforated lid of metal to close it up, but without a better result.

For more than thirty years, there was an attempt to increase the adhesion of dentures by making the rim or the inner part of the dental plate of soft rubber. The result was not good, as the soft rubber will extend and cannot be made as smooth as the hard rubber. Irritation may result, and it is very difficult to remove the soft rubber where it irritates the gum.

Some (Hurst, Meunier, Rose) recommend vacuum chambers of soft rubber, joined in their whole extent firmly to the hard rubber plate. I cannot see any advantage as compared with the common vacuum chambers, in the listed cases in which we need better adhesion, as soft rubber will swell and then either press into the gum tissue or press the denture off the palate, and it takes part in all the movements of the plate in mastication, so that air and food may enter and cause the plate to drop.

Great progress has been made by the invention of movable dental devices of soft rubber in different forms in connection with vacuum chambers. These devices have the great advantage that they will adhere well to the gum and, from their elasticity, do not lose the connection with the dental plate when it moves, even if air enters under the plate. Therefore, the denture is not likely to drop. The device generally used is flat and elliptic. At first when fixed to the vacuum chamber, it is concave, and gives good service. But after some time, it swells, becomes flat and loses a good deal of its sucking power. If the device is too thick and too large for the vacuum chamber, it will rise above it and greatly irritate the gum, so that a severe inflammation may result, especially when such dentures are worn at night. Necrosis and perforation of the palate have even been caused by misuse of such devices. I have seen a case in which too large and too thick devices had been worn for years, day and night, and had caused a hole through the palate, the shape of the suction device.

There are also invented concave devices with several elevated rings all over the side of the gum. I found that they have a good suction, but on account of their bowl-like form, they press the denture off the palate, so that the dental plate adheres more to the suction device than to the plate. Another device (the Wolf) of a concave form becomes very thin to the rim and has fine elevated rings in the middle part of it. I found their suction power not much greater than that of the usual suction devices. Another new device (Gundelich's) is flat, with a flat elevation at the rim, but no corresponding sloping on the back side. This suction device has a thickness of more than 1.5 mm. at the rim and, especially after swelling, is inclined to cause irritation. Another new device is that of Wetzler. This is triangular and flat. I do not regard it as an improvement.

Some more words are to be said about the Petry device or, as it is called, retainer. It is a plate of soft rubber upon which one or more movable suction cups are permanently fixed. These cups are concave and there is a wide space between them. The whole apparatus will be placed with cement in a large vacuum chamber, obtained by two tin-patterns. The Petry suction device is, theoretically, the most effectual instrument to fix a denture to the gum; but, in practice, it has disadvantages. I myself have a protrusion of the lower jaw, and the latter is much broader than my flat upper jaw. I used, at first, for my own mouth, a Petry retainer with five suction cups and, in the beginning, I was well satisfied, but I could not bear the denture for a long time because it gave me much pain. In its thickness of about 2.5 mm., the Petry device will project at least 0.5 mm. above the dental plate, after swelling more than 1 mm. Therefore, the suction cups will press deeply into the palate; whereas, the palate tissue not covered by them has the inclination to fill the vacuum spaces between them and becomes hypertrophic. Besides, the dental plate for the Petry retainer must be made very thick and it takes much time to change the suction.

Suction devices of good function should meet the following conditions:

1. They must be of such shape that even after swelling they will not rise essentially above the vacuum chamber and will not irritate the gum.
2. The suction power must not be diminished in longer usage.
3. They shall not have permanently a deeply curved form, by which the denture is pressed off the gum in such a way that air and food may get under it.
4. The device must adhere to the gum well even during movements of the dental plate in masticating and must prevent its dropping.

After trying most of the known suction devices in my own mouth, I was not satisfied, and so I made up my mind to construct a device that would better accomplish all the foregoing conditions. This new device is called the wall suction (*Wallsauger*). It is also flat but is thinner than the usual suction devices and has, at the rim, a wall 0.5 mm. in height, ending in a fine line; whereas, on the reverse side, the rim is sloped, corresponding with the sloped form of a vacuum chamber at the rim. As the suction device is considerably smaller and thinner than the corresponding vacuum chamber, after swelling the former just fills it.

Only the fine wall will press a little into the gum without irritating it. When just fixed to the plate, the suction device will also have a concave form, but, after a short time, the device enters the vacuum chamber, so that the denture will adhere well to the palate and not be pressed off. As in all dental plates with vacuum chambers, a denture with wall suction should not be worn during the night. This device is now made in four sizes. When the palate is highly arched, two small devices should be used on both sides of the middle line. In cases in which the lower jaw is projecting and broader than the upper jaw, and the denture is likely to tilt, three small suctions should be used in connection with suction lines. I now wear such a plate in my own mouth and have for more than half a year. I have no irritation of the gum and can bite with it almost as well as with my own teeth. The suction device should be changed after three or four months.

The wall suction device in a long narrow form can also be used in special cases for lower dentures, if there is much resorption and a flatness in the back part of the lower jaw. The thickness of these devices should be 1 mm.; whereas the pattern must have a thickness of 1.5 mm. because of the swelling of the soft rubber.

It can easily be proved that the suction power of a wall suction device is more enduring than that of a simple flat type of suction device. If we press the thumb against a wall suction device which has been worn for some time and remove the finger with a jerk, we hear a snapping noise, but much less if we do so with a worn suction device of the common flat form.

I made some tests regarding the swelling of dental suction devices in the saliva in and out of the mouth, and found much difference. The swelling of the device in the mouth is much greater than the swelling in saliva out of the mouth, the cause being the diminishing pressure of air in the vacuum chamber by suction and the pressure on the suction device at the point where the latter is fixed to the denture at the holding point, as the hole in the suction device has to be as small as the neck of the holding button.

ORAL SEPSIS IN ITS RELATIONSHIP TO FOCAL INFECTION AND ELECTIVE LOCALIZATION*

By EDWARD C. ROSENOW, M.D., Rochester, Minnesota

ON several previous occasions, I have reported to the dental profession results of extended study of focal infection and elective localization. It is my purpose, in this report, to review briefly the clinical findings, the results of previous experimental work in my hands as in those of others; to emphasize the more important points still not sufficiently considered in the methods of study; to report additional results of animal experiments with bacteria isolated from dental and other foci, and to correlate the experimental and clinical findings, especially as they pertain to dental problems.

In the further consideration of the question of focal infection, it is not necessary to review at length the clinical evidence as regards the important part localized infections play in the production of systemic disease. The voluminous medical and dental literature which has appeared and in which it is reported that large numbers of patients have been relieved of symptoms after removal of foci of infection, and much additional information, leaves no room for doubt regarding the importance of this principle. Causal relationship on purely clinical grounds, especially in acute localized infections, had been suspected by some clinicians for many years, but, in the case of symptomless foci, little progress was made until experimental proof of causal relationship was worked out in support of the idea. Since then, great progress has been made. Indeed, since about fourteen years ago, when Billings first emphasized the importance of mild, often symptomless foci of infection as the source of serious systemic manifestations, and the earlier experimental work in connection with carefully selected clinical cases, the methods of practice in medicine and surgery, including the various specialties, and even in dentistry, have been greatly modified. The status of dentistry, at least in the United States, has been lifted, it may be said, from that of a mechanical art in which the chief emphasis was placed on preserving teeth, without much consideration of their relationship to the general health except as concerned their mechanical function, to that of a branch of the healing art in which prevention of systemic disease has become the watchword. The diseases that may be directly or indirectly attributed to this source affect, in diverse manner, many different organs or structures. Much clinical evidence in support of this view might be cited, and experimental results are not lacking. The re-

*From the Division of Experimental Bacteriology, the Mayo Foundation.

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TABLE 1.—ELECTIVE LOCALIZATION OF STREPTOCOCCI

Source of Culture	Strains	Animals Injected	Percentage of Animals Showing Lesions in:										
			Joints	Muscles	Endocardium	Myocardium	Stomach or Duodenum	Nerves	Gallbladder	Appendix	Kidneys	Lungs	Intestines
Arthritis	24	37	**43**		15	10	10				15	15	5
Myositis	28	202	33	**80**	8	17	13	9	3	1	9	7	7
Endocarditis	8	44	15	0	**84**	20	7		5	0	20	20	15
Rheumatic fever	24	71	66	27	46	**44**	23		3	8	39		13
Ulcer of Stomach or duodenum	37	168	12	4	10	3	**68**	0	21	1	3	0	7
Neuritis and sciatica	10	59	15	42	3	10	5	**66**	2	3	12	15	
Cholecystitis	12	41	17	7	10	2	29	0	**80**	0	5	5	17
Appendicitis	17	71	29	12	21	9	11	0	1	**70**	0	0	9
Miscellaneous Series I	34	41	17	7	20	15	17	4	4	3	7	7	4
Miscellaneous Series II	71	212	9	12	12	4	9		1	1	9	7	

production in animals of the disease from which a patient is suffering, with bacteria isolated from a focus, is far more important than the clinical observation of improvement or relief from symptoms following removal of a particular focus. It is the best proof we have of an etiologic relationship between microbes and a given disease. Progress in the future, even more than in the past, will depend on combined clinical and experimental study.

Experimental evidence of causal relationship between bacteria, usually streptococci, isolated from foci of infection, and systemic disease has been brought forward in my own work in acute appendicitis, ulcer of the stomach or duodenum, cholecystitis, pancreatitis, acute and chronic arthritis, rheumatic fever, acute iritis, acute and chronic myositis, subacute bacterial endocarditis, erythema nodosum, herpes zoster, neuralgia, transverse myelitis, epidemic encephalitis and poliomyelitis, and chorea; twenty-two quite distinct disease entities. In the earlier work, most of the strains worked with were derived from tonsils or from the systemic lesions, although comparable results were also obtained with streptococci isolated from different foci in the dental area, such as pyorrheic areas, the apical end of pulpless, radiologically positive and negative teeth, the granuloma, the so-called blind abscess and discharging dental fistulas.

The results obtained after intravenous injection in animals of freshly isolated cultures from foci in some of the diseases studied are summarized in Table 1, and these will serve to illustrate with what regularity the causative organisms, usually streptococci, occur in foci of infection in persons suffering from systemic disease. The incidence of lesions in the various organs is recorded in percentages, and hence is comparable throughout the table. The high incidence of lesions in the specific organ or organs in each of the diseases studied is in sharp contrast with the low incidence in the miscellaneous or control series. The difference between the percentages indicating the incidence of lesions in the specific organ after injection of the corresponding strains and in the same organ after injection of miscellaneous strain may be regarded as expressing the elective localizing power of the specific strains in the different diseases studied. It is this property in the bacteria, inherent or acquired, probably more than any other factor that determines the location of systemic disease secondary to foci of infection. Experimental proof, in addition to results following intravenous injection, of the correctness of this view are not lacking. Other methods of injection, such as intraperitoneal, intratracheal and subcutaneous, sometimes suffice to affect characteristic localization. Moreover, in experiments in chorea and epidemic hiccup, characteristic symptoms followed the devitalization and infection of teeth in rabbits and dogs with the respective streptococci isolated.

In my experiments conducted with Meisser, specific localization occurred from the teeth of dogs infected with bacteria from cases of nephritis and of nephrolithiasis. A staphylococcus isolated from a focus of infection in a case of advanced nephritis localized in the kidney and produced outspoken nephritis. In a series of experiments, renal calculi were produced in this way with streptococci isolated from the urine or foci of infection, including pulpless teeth, of patients suffering from nephrolithiasis

and who had recurring attacks of renal colic due to stones. Calculi or lesions of the medulla of the kidney were produced in 87 per cent of thirty-four dogs whose teeth were infected with streptococci from the urine, infected teeth and tonsils of nine patients with typical nephrolithiasis. The duration of the experiment on the dogs in which the findings were negative was too short for stones to form. This is in sharp contrast to the findings in an equal number of dogs whose teeth were infected with strains from other sources, and to those of a larger series kept under the same conditions but in which the teeth were not infected.

The experimentally produced calculi were similiar in physical properties and chemical composition to those found in nephrolithiasis in man. The number and size of the stones were often proportional to the duration of the experiment. The other findings in the urinary tract were also similiar to those occurring in patients with this disease.

If albumin, pus and blood were present in the urine, there were only small amounts; and the lesions in the medulla of the kidneys were relatively slight unless ureteral obstruction from an impacted calculus occurred, when marked ascending infection developed just as it commonly does in patients with partial obstruction of the ureter.

The streptococcus inoculated into the teeth of dogs was isolated from the kidneys, from some of the stones and from the teeth, at the end of the experiments, and its elective affinity for the urinary tract in rabbits was demonstrated on intravenous injection. The streptococcus from the teeth of dogs that showed active lesions in the kidneys had retained specific affinity for the kidneys of rabbits, while those from the dogs that showed no lesions or only healed lesions had lost this peculiar localizing power. The organism was found in the lesions in the substance of the kidney where crystallization and stone formation were beginning.

The streptococcus inoculated into the pulp canals was isolated from the infected material in the root canals or the periapical tissues of the pulpless teeth at the end of each experiment. This was true alike of the three cuspids that were devitalized but not infected. In some instances, secondary infection by a small gram-negative bacillus, and more rarely by a staphylococcus, had occurred. The streptococci in the teeth in which secondary infection had not occurred were especially numerous at the periphery of well-formed granulomas and where the bone was being absorbed. The findings around the teeth were similiar to those following the devitalization of the teeth in persons, as practiced in dentistry: the infected teeth became discolored, but remained firmly in place in the alveolar sockets; the infection caused rarefaction and absorption of bone in the periapical region without swelling, pain or tenderness, and the cellular infiltration and distribution of the bacteria of well-formed granulomas were also similar. The experimentally produced chronic foci, aside from being the source of the streptococcus that tended to localize electively in the urinary tract, appeared to have a general deleterious effect. Some of the dogs lost markedly in weight and became more suseptible to intercurrent infection, particularly when unusually large areas of infection around the teeth had developed and when the renal calculi were large. Moreover, Meisser, in another series of experiments in which the teeth of dogs were infected with the

TABLE 2.—LOCALIZATION FOLLOWING INTRAVENOUS INJECTION OF STREPTOCOCCI ISOLATED FROM FOCI OF INFECTION IN VARIOUS DISEASES AS OBTAINED BY DIFFERENT INVESTIGATORS.

Investigator	Percentage of Animals that Developed Specific Lesions in Cases of																	
	Arthritis		Myositis		Ulcer of Stomach or Duodenum		Cholecystitis		Ulcerative Colitis		Myocarditis		Endocarditis		Pyelonephritis		Neuritis		Iritis	
	Cases	Controls	Cases	Controls	Cases	Controls	Cases	Controls	Cases	Controls	Cases	Controls	Cases	Controls	Cases	Controls	Cases	Controls	Cases	Controls
E. C. Rosenow	66	17	80	12	68	9	80	4			38	4	84	20	80	5	66	4	60	10
J. G. Meisser	67	10	81	15	67	8									76	5				
R. O. Brown					67		57													
T. Nakamura	85	24			70	25														
L. M. Moench	53																			
J. A. Bargen									52				79							
A. C. Nickel	77	7	69	4	68	3			50	2	62	3					36	1	62	2
R. L. Haden					53	7					84				89	40			68	13

streptococcus of ulcer, obtained similar results, but the animals developed lesions of the stomach instead of renal calculi. Thus, of twenty dogs in each of which four cuspids were infected with the streptococcus isolated from infected teeth of three patients having ulcer of the stomach, thirteen (65 per cent) developed hemorrhagic lesions in the stomach, and nine (45 per cent) developed ulcer. Microscopic examination of the ulcers and granulomas at the apices of the teeth revealed leukocytic infiltration, connective tissue formation and the streptococcus. The streptococcus isolated from the teeth of animals many months after inoculation retained its affinity for the stomach of rabbits, on intravenous injection, producing hemorrhage and ulcer shown to be due to the streptococcus injected.

The results obtained in elective localization on intravenous injection have been fully corroborated and extended in important respects by co-workers in the laboratories of the Mayo Foundation, as well as by independent investigators. Meisser has reported such results in a long series of experiments with streptococci isolated from dental foci in cases of submucous ulcer of the bladder, and Meisser and Brock in various forms of chronic arthritis. Numerous instances are cited in which relief from symptoms followed removal of infected teeth shown to contain the causative organism. Nakamura, working with streptococci isolated from extirpated tonsils, in cases of ulcer of the stomach or duodenum and of arthritis, obtained a much higher incidence of lesions in these respective organs than after injection of strains from miscellaneous cases (Table 2). Giordano, working in my laboratory, proved the elective localizing power of streptococci isolated from pulpless teeth after death, in cases of perforating ulcer, of gastric hemorrhage and of perinephritic abscess. Moench, through similiar studies in animals, has shown that partial-tension streptococci isolated from the cervix of patients suffering from endocervicitis and arthritis have marked affinity for the joints of animals (Table 2). Brown has corroborated the work on cholecystitis, and Ashby on myositis (Table 2). Canter, in an as yet unpublished work, has corroborated my results in ulcer of the stomach. He has applied the method in a study of the etiology of goiter and has found that certain streptococci isolated from the thyroid in this disease tend to localize and produce lesions in the thyroid of animals. Bargen, by the use of similar methods, has isolated from the ulcers in the colon and from tonsils and teeth in chronic ulcerative colitis a diplostreptococcus, which has marked affinity for the colon of animals, producing numerous hemorrhages and ulcerations, and diarrhea. He reports cases in which relief from symptoms following the use of vaccines is merely temporary unless evident foci, even pulpless radiologically negative teeth, are removed; whereupon recovery appears to be permanent.

Helmholz and Gerdine, by the use of similar methods, have shown that epidemics of duodenal ulcer in children are due to streptococci having peculiar affinity for the duodenum. Kennedy has reported the finding of large numbers of streptococci in small ulcers of the stomach or duodenum, the source of fatal intestinal hemorrhage in cases of melena neonatorum. Helmholz and Beeler have demonstrated elective localizing power in strains of *Baccillus coli* and streptococci isolated from pyelonephritis. Price has reported instances

of specific localizations of streptococci isolated from dental foci. Nickel, working with me in a long series of experiments performed during the last two years, has corroborated and extended the work in arthritis, in myocarditis and endocarditis, in iritis and in ulcer of the stomach or duodenum (Table 2). Moreover, in order that there might be an experimental basis for estimating the relative importance of different foci of infection, he made cultures and animal inoculations from tonsils, teeth, prostate and cervix, as a routine in a series of cases with definite symptoms of systemic disease and in miscellaneous cases of vague complaints. The incidence of specific localization with cultures from dental foci in each of the diseases studied was higher than with cultures from other foci, a point of particular interest to dentists.

Thus, 60 per cent of the animals injected with cultures from the teeth of patients having arthritis developed lesions of the joints, in contrast to an average of 51 per cent of all foci; 50 per cent of the animals injected with cultures from dental foci developed lesions of the heart in the cases of myocarditis and endocarditis, in contrast to an average of 39 per cent of all foci; 41 per cent of the animals injected with streptococci from dental foci developed lesions of the eye in the cases of iritis, in contrast to 34 per cent of all foci, and 44 per cent of the animals injected with cultures from teeth developed lesions of the stomach or duodenum in the cases of ulcer of the stomach or duodenum, in contrast to 40 per cent of all foci. The percentage incidence of lesions in these organs in the miscellaneous or control group was much lower, being 7 per cent in joints, 3 per cent in the heart, 1 per cent in the eyes and 3 per cent in the stomach or duodenum. The incidence of specific localization in this series is considerably lower than that obtained in my earlier work (Table 1) and in the new work reported in this paper (Table 3). This, no doubt, is due to the fact that the series includes all routine cases. The incidence of specific localization in selected cases, when the clinical condition indicated probable causal relationship between the focus and the systemic disease, was considerably higher, being 77 per cent in the group with arthritis, 62 per cent in the group with cardiac lesions, 75 per cent in the group with iritis and 80 per cent in the group with ulcer. Nickel also reports instances of prompt relief from systemic diseases following removal of foci proved to contain the causative organism.

Especially noteworthy is the independent corroboration of this work by Haden (Table 2). Not only has he obtained comparable results in diseases studied by me and my co-workers but he has also applied the methods to conditions in which the possibility of focal infection as having etiologic significance was not even considered by clinicians. Thus, in a series of cases of persistent infection about the roots of nails of the fingers or toes (perionychia), he has isolated from tonsils or teeth, streptococci that localized electively and produced lesions around the roots of claws of rabbits after intravenous injections, an example of extreme specificity. Moreover, removal of the responsible focus resulted in a complete cure. He has also reported similar highly specific results following injection of streptococci isolated from teeth of patients having disease of the heart and blood vessels.

TABLE 3.—LOCALIZATION IN ANIMALS OF STREPTOCOCCI FROM FOCI OF INFECTION IN PATIENTS SUFFERING FROM SYSTEMIC DISEASE.

Source of Cultures	Cases	Animals		Cases Yielding Positive Results	Percentage of Animals that Developed Lesions in:												Cultures from			
		Injected	Died		Skin	Muscles	Joints	Intestines	Stomach or Duodenum	Gallbladder	Kidneys	Lungs	Myocardium	Endocardium	Pancreas	Nerves	Specific Lesion		Blood	
																	No.	Positive Percentage	No.	Positive Percentage
Chronic arthritis	17	41	11	15	0	**46**	**66**	0	15	0	5	5	5	7	0	0	27	70	38	58
Ulcer of stomach or duodenum	40	90	18	34	0	7	2	3	**61**	0	3	2	7	1	0	0	10	80	69	32
Cholecystitis	21	57	28	18	0	4	0	9	22	**65**	11	4	12	0	11	0	42	67	54	72
Myositis	3	7	2	2	0	**71**	**29**	0	0	0	14	0	0	14	0	14			6	17
Neuritis	6	26	6	5	0	12	0	0	0	0	0	0	8	8	0	**58**			10	60
Pyelonephritis	5	15	2	4	0	20	14	0	0	0	**80**	0	7	7	0	0	6	67	10	20
Endocarditis	3	10	1	2	0	10	0	0	30	0	30	10	10	**50**	0	0	1	1	10	40
Erythema nodosum	1	12	0	1	**75**	**67**	42	0	0	0	17	0	0	0	0	0			12	0
Herpes zoster	11	31	13	6	**35**	13	6	0	0	0	0	0	0	0	0	0			29	38
Diabetes	8	29	11	6	0	0	7	0	7	0	3	0	0	0	**48**	0	11	37	21	33
Chorea	6	19	6	3	0	26	26	0	0	0	5	0	21	**47**	0	0	5	60	18	33
Total	121	337	98 29%	95 78%													102	66	277	43
Miscellaneous	62	129	39 30%		1	9	6	0	4	0	2	3	3	5	0	2			77	32
Results exclusive of specific strains					0	9	5	2	8	0	6	2	7	3	2	0				

Through the work of Meisser and of Haden, we have come to recognize more than heretofore, the importance of dental foci, particularly the pulpless tooth, in the causation of systemic disease. Both have shown that the organism responsible may be present in one but not in other dental foci, a point not yet sufficiently considered in attempting to evaluate clinical results following removal of infected teeth.

Few advances in medical thought have given rise to as much discussion as has the work on focal infection and elective localization, especially as pertains to dental practice. Indeed, formal debates for and against the idea have been staged. That there should be difference of opinion is not surprising. The idea is applicable to a wide range of diseases. The responsible foci may be harbored in widely separated regions of the body, requiring consideration by specialists in various branches of the healing art. Since bacteria are very small, their specific infecting power may be sufficiently high to enable them to gain entrance through small defects, too small to be detected, or even through the normal mucous membrane, and thus they may produce systemic disease without the existence of a detectable focus. This is especially liable to occur in epidemic diseases. The bacteria in systemic lesions may be so thoroughly entrenched that removal of foci may not have sufficient effect to be detectable clinically. The idea calls for a radical change in the concept of the origin of many diseases, and this is always difficult, especially by those who know. The bacteria, usually streptococci, proved responsible in many of the diseases studied are, aside from specific infecting power on isolation, much alike, and hence extraordinary proof of causal relationship is required. Moreover, they are often extremely sensitive to oxygen and are easily missed and tend to lose specificity when cultivated on artificial mediums and when passed successively through animals, this making it extremely difficult to obtain experimental proof of causal relationship.

The dosage that has been used in the earlier studies on elective localization has been criticized by some. It is granted that the number of bacteria injected was very large in routine work, but it must be remembered that markedly different and highly specific effects were noted when dosage was constant in the cases of definite disease, which was not the case in the controls; that the animals used are probably far more resistant to these organisms than persons from whom the organisms are isolated; that only one or several injections are made, and that, in the case of foci, as in tonsils or apical ends of teeth teeming with organisms, opportunity for entrance of organism or their toxins is afforded in varying degree, not during a fraction of a minute as is the case on intravenous injection, but over periods of hours, days, weeks or even months. Only a small proportion of the animals succumb to the injection. Most of them remain seemingly well, as do patients, but on examination are found to have specific lesions. Their blood, as that of patients, is usually sterile or contains few organisms, or tends to become sterile soon after injection. Negative results have been obtained repeatedly in control experiments in which equivalent doses were given with cultures made from the surface of the buccal or gingival mucous membrane obtained just before pulpless teeth were drawn, when a high incidence of elective localization was obtained with cultures from the

apical end of the teeth. Radiologically negative teeth have repeatedly yielded the specific organism when cultures from the throat or tonsil proved negative (Fig. 1). Extremely small doses sufficed to produce positive results in special instances. Thus, herpes was produced in rabbits with a filtrate of a streptococcus culture containing not more than ten living streptococci. Specific localizations have occurred after the introduction of bacteria by methods other than intravenous injections, such as intratracheal, intra-intestinal, intraperitoneal and subcutaneous injection. Fetuses of rabbits developed lesions of the muscles or the lungs proved to contained the streptococcus from cases of myositis and influenza, respectively, which were injected intravenously into the pregnant animal.

Fig. 1.—Above: Pulpless tooth. Below: The agar-shake cultures from its apex, of a patient with arthritis deformans. The absence of rarefaction and relatively large number of colonies of streptococci in the deeper, more anaerobic part of the culture may be noted.

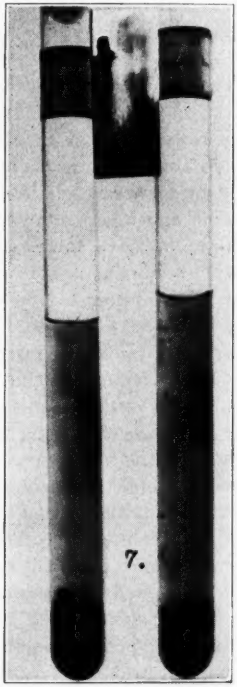

Fig. 2.—A vital (left) and pulpless (right) tooth in a case of hypertrophic arthritis and the corresponding cultures from the apices after extraction, the pulpless tooth being extracted first. The absence of rarefaction at the apices, the absence of growth in the culture from the vital tooth, and the large number of colonies in the culture from the pulpless tooth may be noted.

Moreover, there was a high incidence of specific lesions in a series of experiments in which suspensions of relatively small numbers of bacteria that had grown within foci in patients having different diseases were injected directly, intravenously, into animals. Thus, suspensions of pus from tonsils or emulsions of extirpated tonsils from twenty-four cases of chronic arthritis and myositis were injected intravenously into thirty-seven rabbits. Of these, 62 per cent developed lesions of the muscles and 43 per cent lesions of joints. The highest incidence of lesions in the other organs was 15 per cent. Four of five rabbits injected with material from tonsils of four patients having ulcer of the stomach developed ulcer. One of two rabbits injected with material from a patient having cholecystitis developed lesions of the gallbladder. Four of eight rabbits injected with material

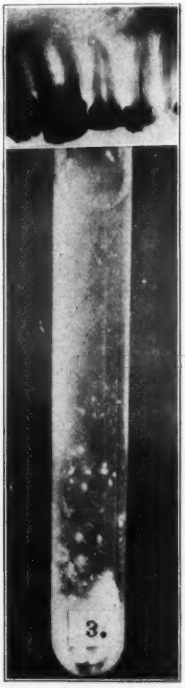

Fig. 3.—Above: Vital and pulpless teeth in a case of chronic arthritis. Below: Agar-shake culture of the apex of one pulpless molar. The large number of colonies in the lower part of the tube and the absence of rarefaction about the apex may be noted.

Fig. 4.—Above: Vital and pulpless teeth in a patient suffering from sciatica. Below: The agar-shake culture of the roentgen-ray negative pulpless tooth. The questionable area of rarefraction and the large number of colonies, especially in the middle zone of the culture, may be noted.

from four patients having neuritis developed gross lesions of nerves, and three of seven rabbits injected with material from three patients having herpes zoster developed lesions of the skin. Finally, the positive findings in the dogs whose teeth were injected with the bacteria from chorea, epidemic hiccup, nephritis, nephrolithiasis and ulcer of the stomach leave no room for doubt as regards the possibility of foci of infection and elective localization being important factors in the production of disease.

It has been suggested that streptococci often occur normally in the tissues of animals, and that since the strains injected do not always possess distinctive morphologic and cultural characteristics, the streptococci isolated or demonstrated in the lesions may be secondary invaders and not the ones injected. This point has also been considered and has been found not to apply. Most of the animals injected were rabbits. Control cultures and sections made of rabbits in connection with these experiments, in experiments following injection of sterile filtrates, sodium chlorid solution and broth, and following intracerebral injections of streptococci from various diseases of the nervous system, show that invasion of streptococci is very rare in this species of animal, and therefore confusion of strains in cultural work is extremely unlikely. The demonstration of organisms in the lesions and their proved absence in adjacent normal tissue may hence be regarded as almost conclusive proof of causal relationship.

Filtrates of cultures of streptococci having specific localizing power have been shown to contain the toxin or poison that tends to produce lesions by election in the identical structures when injected intravenously, as do also the bacteria killed by heat or solution of formaldehyd. This I have shown to be the case especially in the streptococcus of ulcer and of epidemic hiccup, a finding of great importance, since it helps to explain elective localization.

Some investigators have failed to corroborate in one or more respects my early findings, despite the emphasis I have placed on the importance of strict attention to technical details. This, too, is not surprising considering the nature of the circumstances involved. The results in studies such as these are at best only relative and not absolute. Corroboration has since been obtained at the hands of so many that the negative results obtained by some, as emphasized by Haden, were due, no doubt, to differences in technic even though seemingly the same, or perhaps to the improper selection of cases or of material for cultures.

METHODS OF STUDY

The methods of study, while relatively simple, require procedures and judgment not always easily fulfilled. We have learned, for instance, that a higher incidence of localization and more marked lesions in animals are obtained if cultures are secured at the time of acute systemic manifestations or during exacerbations of symptoms in chronic conditions than if cultures are taken during quiescent intervals. Great care is exercised in the collection of material for study. Pus is expressed from the depths of tonsils and cultures are made from this instead of swabbings from the surface. Pus from pyorrheal pockets is aspirated with fine pipets from the depths of the pockets around the teeth. Through the cooperation of

Gardner and Austin, pulpless teeth are extracted under as nearly sterile conditions as possible, and, in special instances, the apical end is resected for culture before the tooth is extracted.

Granulomas are placed in solution of formaldehyd for section immediately on removal or after incubation for from eight to ten hours in the bottom of a tube of glucose brain broth. The apical one fourth of a tooth is removed immediately after extraction, while being held in the extracting forceps, and not after being wrapped in gauze or placed in sodium chlorid solution as is so often the case. The apical end is then shaken vigorously according to the method of Haden, in 2 c.c. of sodium chlorid solution or gelatin (Locke's solution) containing sterile sand, and the suspension thus obtained used for making cultures. In this way, control cultures of the apex of vital teeth have sometimes proved negative or showed few colonies when that of pulpless even radiologically negative teeth from the same patient have shown heavy growth (Fig. 2).

Cultures from vital teeth are also made by aspirating material from the pulp after sterilizing the tip of the root in a flame and then cutting it off with sterile forceps and by planting the pulp after sterilizing the surface of the tooth with alcohol, and splitting it in a vice when wrapped in sterile gauze. Most strains of streptococci, especially those from the apex of pulpless teeth that are found to have elective localizing power, are highly sensitive to oxygen on isolation, growing only at the bottom of glucose-brain-agar (Fig. 3); while others grow under partial tension conditions as occurs in the middle zone (Fig. 4), and some grow well under aerobic conditions. Hence, cultures are made in mediums furnishing a wide range of oxygen tension. Inoculations are made as a routine on the surface of blood-agar plates and throughout the length of tall columns of glucose-brain-broth and glucose-brain-agar. The agar is previously melted, boiled and cooled to body temperature, and the inoculum is evenly distributed in the agar by inverting the tube twice before the agar sets.

The glucose-brain-broth, in our earlier work, was prepared from dehydrated bacto broth by dissolving 8 gm. in 1,000 c.c. of distilled water, adding 8 gm. of sodium chlorid, 2 gm. of chemically pure dextrose and, after cooling, 10 c.c. of Andrade's indicator. More recently, it has been found that 0.2 per cent glucose-broth prepared from beef infusion in the usual way and titrated to a p_H of 7.4 serves the purpose equally well. The glucose-brain-agar is prepared from the broth by adding 7 gm. of powdered agar to each liter; just sufficient to set. After cooling, the mediums are placed in tubes (20 by 1.5 cm.), the column in each being at least 12 cm. tall. To each tube is added three pieces of calf brain about 1 cm. square, and two or three pieces of calcium carbonate, preferably as crushed marble. This is then sterilized for twenty minutes in the autoclave at 20 pounds pressure.

The soft glucose-brain-agar medium makes it possible to estimate the number and kinds of organisms in the inoculum. The pieces of brain absorb the oxygen in the deeper layers of the mediums, methylene blue being rendered colorless, and tend to lower the surface tension of the mediums. The cultures are incubated at 35 instead of at 37.5 C.

Growth usually occurs within twenty-four hours, and in most instances, especially in the case of cultures from teeth, begins at the bottom of the

tube (Fig. 4), forcing its way to the top as oxygen is consumed. In the glucose-brain-broth, this usually occurs within twenty-four hours, while in the glucose-brain-agar, growth to the top, or more often to within 1 cm. of the top,

Fig. 5.—Agar-shake culture from a roentgen-ray negative pulpless tooth of a patient suffering from encephalitis, Parkinsonian type. The large number of colonies throughout the culture may be noted. Cultures from the tooth produced encephalitis in rabbits, whereas those from the nasopharynx were without effect.

takes from two to three days. Negative cultures are observed daily for a week or ten days before they are discarded. Colonies in the agar may be exceedingly small or develop only around the pieces of brain at the bottom and may easily be overlooked, or they may be so numerous as to give the appearance of a

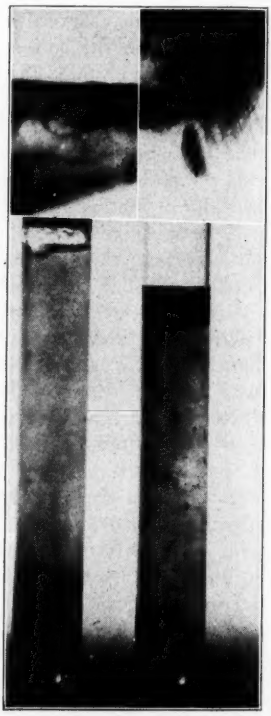

Fig. 6.—Above: A residual area and the apex of a tooth. Below: The corresponding agar-shake cultures. The innumerable number of extremely small colonies of streptococci from the residual area and the moderate number of colonies from the root tip may be noted.

negative culture. Animals are injected usually with a twenty-four-hour primary culture in glucose-brain-broth or sometimes with pure cultures in this medium obtained from single colonies

of the primary inoculations in soft glucose-brain-agar. Subcultures from aerobic growth on blood agar usually give negative results. The dose injected as a routine, in the more recent work, was approximately from one-fifth to one-tenth as great as was used in the earlier work, this depending on the size of the animal, the source of the strain or the particular purpose in mind. From 5 to 7 c.c. of the primary growth in glucose-brain-broth of material from the focus was injected intravenously. The injections were usually not repeated, although, in attempts to produce chronic lesions, we sometimes gave daily injections, thus making repeated onslaughts and simulating what no doubt occurs from foci of infection. The animals selected were from healthy stock and were fed in the usual way and were observed daily. Those that died from the effects of the injections were examined as soon after death as possible, and those that survived were chloroformed in from two to four days after the last injection. Search for lesions was made in a strong light. Lesions such as obtained in these experiments almost never occur in animals that die from intermittent causes or that are chloroformed as controls. Serving as a further check is the fact that highly specific localizations were obtained consistently when material from different disease entities was injected by myself and co-workers, into animals from a common supply. Cultures were made, as a routine, from the blood and sometimes from specific lesions and, for controls, from other tissues. Streak cultures on blood-agar and inoculation into tall tubes of glucose-brain-broth were made. Blocks of tissue were fixed in 10 per cent solution of formaldehyd. Paraffin sections were made, and were stained with hematoxylin and eosin for lesions and, by a modified Gram method, for bacteria.

FURTHER EXPERIMENTAL RESULTS

I wish now to report the results of studies on the intravenous injection of animals with cultures freshly obtained from various foci of infection, chiefly from patients suffering from widely different diseases who were seen in consultation with the attending physician in the Mayo Clinic, in the hope that animal experiments might assist in the diagnosis of obscure conditions or yield the causative organism from which a specific vaccine might be prepared and which might prove of therapeutic value. The technic was essentially alike throughout the period of study and as described above. The findings are summarized in Table 4. Eleven groups of patients suffering from distinct diseases and one group having miscellaneous or vague complaints have been studied. The figures indicating the incidence of lesions in the various organs and the incidence of the isolation of the organism injected from the specific lesions or blood are given in percentages and are therefore directly comparable. A high incidence of lesions in the organs of animals corresponding to the ones affected in patients was found in each of the diseases studied. Thus, the cultures from foci of infection from seventeen patients suffering with chronic arthritis produced macroscopic lesions in the joints in 66 per cent and in muscles in 46 per cent of the forty-one animals injected. The highest incidence of lesions in the other organs was 15 per cent (in the stomach). One or more of the animals injected with cultures from fifteen of the seventeen cases developed specific lesions. The cultures injected

in this group were obtained from the tonsils in five, from the throat in three and from infected teeth in nine cases. All of the latter yielded positive results, most of them from chronic or recurring ulcer. Of forty cases of ulcer of the stomach or duodenum, thirty-four yielded specific results in one or more of the animals injected. Sixty-one per cent of the ninety animals injected developed lesions of the stomach or duodenum. Of these, only eighteen died. The rest were seemingly well and the lesions were found after they were chloroformed for examination. Twelve of the strains in this series were isolated from excised ulcers; the rest were from the teeth, tonsils or nasopharynx in twenty-one cases. In the cholecystitis group, 65 per cent of the fifty-seven animals injected developed lesions of the gallbladder. Eighteen of the twenty-one strains yielded positive results. Only three of the twenty-one strains in this series were isolated from foci of infection, all yielding positive results, while eighteen were isolated from the gallbladder in cases of cholecystitis. The streptococcus from two of the three cases of myositis produced lesions of muscles in animals. Seventy-one per cent of the seven animals in-

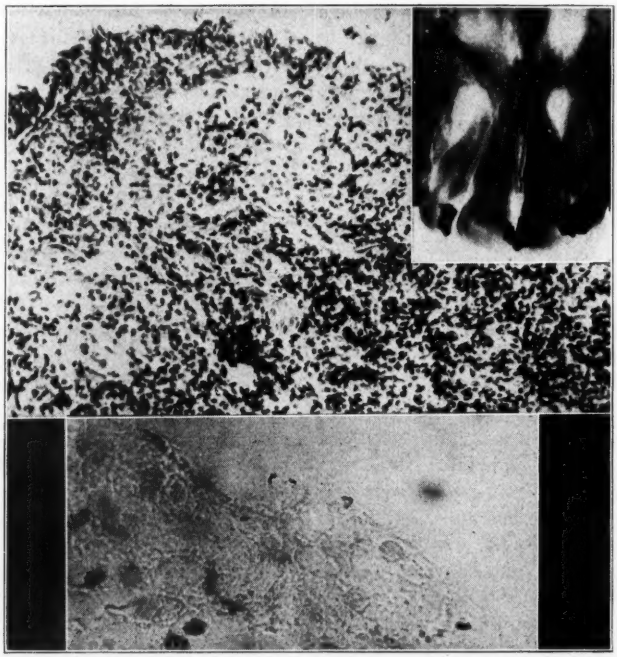

Fig. 7.—Teeth in a patient suffering from corneal ulcer (insert), and section of the granuloma. The area of rarefaction at the apex of the pulpless tooth, the cellular infiltration and the diplococci in the periphery of the granuloma may be noted.

jected developed lesions in muscles and 29 per cent in joints. Streptococci from foci in all of the six cases of neuritis (acute cases) produced lesions in the nerves of one or more animals injected. Fifty-eight per cent of the twenty-six rabbits injected developed gross lesions of one or more nerves. Eighty per cent of the fifteen animals injected in the pyelonephritis group developed lesions of the kidney. Five (50 per cent) of ten rabbits injected with the streptococcus from foci in the three cases of endocarditis developed lesions of the endocardium or heart valves. Seventy-five per cent of the twelve animals injected with a streptococcus from one case of erythema nodosum developed hemorrhage or infiltrative lesions of the subcutaneous tissues, and 67 per cent lesions of the muscles, chiefly superficial muscles of extremities. Thirty-five per cent of thirty-one animals injected with streptococci from foci in cases of herpes zoster developed lesions of the skin, some of which resembled herpes. Forty-eight per cent of twenty-nine animals injected with cultures from foci in cases of diabetes developed mild lesions of the pancreas. Forty-seven per cent of nineteen rabbits injected with cultures from foci in six cases of chorea developed lesions of the endocardium, chiefly of the heart valves; 21 per cent, of the myocardium, and 26 per cent, of muscles and joints. The three cases yielding positive results were of the "rheumatic" type, while the three in which no lesions developed were of the "encephalitic" type.

These high percentages representing specific or elective localizations are in sharp contrast to the low incidence of localization in 129 rabbits injected with cultures from similar sources in the sixty-two miscellaneous cases and the low incidence of lesions in the different groups exclusive of specific strains. The incidence of specific lesions in this new series of cases is only slightly lower than in my former studies. At the same time, nonspecific lesions were far less common, corresponding to the smaller number of bacteria injected. Altogether, ninety-five (78 per cent) of the 121 cases, representing eleven disease entities in which there was no doubt of the diagnosis, yielded positive results in one or more of the animals injected. Only ninety-eight (29 per cent) of the 337 animals injected died. Cultures were made of the specific lesions in altogether 102 instances, including the groups of arthritis, ulcer, cholecystitis, pyelonephritis, endocarditis, diabetes and chorea. Of these sixty-seven (66 per cent) yielded the streptococcus injected. Cultures were made of the blood after the death of 277 animals. Only 43 per cent yielded the organism; in the others, it had disappeared. Only rarely was the blood heavily seeded even in animals that died, while in those that were seemingly well and were chloroformed, the blood-agar platings were nearly always negative, the positive cultures being obtained in the glucose-brain-broth.

The mortality rate in the miscellaneous group was about the same. Only 39 (30 per cent) of the 129 animals that were injected with material from sixty-two cases died. The others were chloroformed for examination and were found to be free from lesions in nearly every instance. The incidence of positive cultures from the blood was somewhat lower than in the other groups, 32 per cent of the seventy-seven cultured yielding organisms, mostly streptococci.

Of the 121 cases of definite systemic disease, the culture for injection was

obtained from tonsils in thirty-five cases; from teeth, chiefly pulpless teeth, in forty-four; from throat or nasopharynx in thirteen, and from specific lesions such as excised ulcers, gallbladders or pieces of muscle, in twenty-nine. The cultures from the sixty-two miscellaneous cases were obtained chiefly from tonsils, teeth, throat or other foci. In most of the cases studied in this group, there were only vague complaints, such as neurasthenia, aches and pains in various parts of the body, bronchitis and lack of endurance. Some of the patients were well and were used as controls while others had definite diseases, although they do not yield results in this type of study; such as pernicious anemia, epidemic jaundice, toxic erythema and recurring attacks of acute tonsillitis without systemic localization. There were twenty-three cases in this group of systemic diseases in which specific localization was not obtained. Of these, only four were studied during the winter months when exacerbations of symptoms in such cases are common. In the others the animal tests were made during the warmer months of the year; five during the spring and seven each during the summer and autumn. Most of the twenty-three cases had relatively mild symptoms at the time of study. The incidence of specific lesions in the animals in this as in Nickel's series was definitely higher with cultures obtained from infected teeth than with those obtained from other foci, as was also true of strains isolated from the affected organ, such as ulcer of the stomach and gall-bladder. The latter finding is in agreement with what I have found in the earlier work.

Thus, all of the nine cases of arthritis in which cultures from teeth were injected yielded positive results, in contrast to six of the eight cases in which the culture injected was obtained from other foci. All of the five strains obtained from infected teeth in the ulcer group, and all but two from excised ulcers, yielded positive results; while four of the twenty-three strains obtained from tonsils or throat yielded negative results.

The figures or statistical representation of the effects obtained in animal experiments given in Table 3, striking as they are, do not adequately express the findings. The lesions produced in the organ corresponding to the one affected in the patient following injection of specific strains are often much more pronounced than are those in these structures following injection of strains from other sources. The value as given in Table 3 of a small hemorrhage in or around one joint or of slightly turbid joint fluid following injection of a strain from a case other than arthritis is as great as one or more greatly swollen joints with numerous hemorrhages containing markedly turbid joint fluid, as commonly follows injection of strains from a case of arthritis. The occurrence of lesions in a small percentage of animals in organs besides the one affected in the patient from whom the culture is obtained does not minimize the significance of the results obtained, for some patients have transient symptoms referable to other structures besides those chiefly and persistently affected. If the patient had outspoken symptoms of more than one disease, such as arthritis and cholecystitis, localization in both joints and gallbladder often occurred. Nor is this all. Throughout all this work, it has been possible, through the rather unique conditions at the Mayo Clinic, to consider carefully studied laboratory findings in conjunc-

tion with clinical cases. Many, but, of course, by no means all, of the patients, after they had had one or more foci removed in which the causative organism was demonstrated, experienced relief from symptoms that had persisted, in some cases, for many months or even years, in spite of the application of the best therapeutic methods known to medical science. Nor was the relief of short duration; in some, it is known to have continued for as long as five years. Complete relief from symptoms occurred in some instances. Teeth with "perfect" root canal fillings which were placed in a sterile manner by experts after the scrapings from root canals were proved sterile, and which had been watched and remained symptomless and roentgen-ray negative, were extracted; and from these were isolated streptococci that produced marked lesions in animals in tissues corresponding to those affected in the patient. Moreover, cases have been studied in which parallelism between animal experiments and clinical results occurred on repeated occasions. In some of these cases, recurrence of symptoms following the removal of one or more foci was considered by clinicians as indicating that foci played no part in the production of symptoms, when a further study revealed the fact that one or more foci had been overlooked or had developed after an earlier study, and removal of the additional focus or foci was followed by relief from symptoms. In some instances, unsuspected symptomless residual areas of infection in the jaw from which the teeth had been extracted years before were found to contain the causative organism, and after eradication of such areas, there was relief from symptoms.

The results in the new series of cases corroborate and extend those obtained in previous studies. The total number of new cases studied and the number of animals injected is sufficiently large; the period covered (five years) is sufficiently long; the diseases studied are sufficiently varied, and the results are so consistent as to be of significance and to warrant drawing the conclusion that both focal infection and elective localization are important factors in the etiology of disease.

It must not be supposed that the methods employed in our studies, which have been so consistent and which have given so much useful information in the diseases studied, yield positive results in all diseases in which they have been applied. Thus far, only negative results have been obtained in pernicious anemia, lymphatic and myelogenous leukemia, hematuria, certain manifestations of the skin, chronic diseases of the eye and catarrhal and epidemic jaundice. There are good reasons for believing, from purely clinical observation, that focal infection may play an important part in the production of diseases in which experimental studies have thus far been negative or have not been attempted and in conditions in which causal relationship is not even suspected. Indeed, Nickel, working with me, has already shown in preliminary experiments that streptococci isolated from teeth in cases of miscarriage have elective affinity for the uterus or placenta of animals, causing abortion. This includes teeth whose root canals were perfectly filled, that were symptomless and normal to the radiogram. Nickel's work with cultures from similar teeth in cases of heart disease is also yielding suggestive results and points in the same direction. The clinical study by Post and Stiegletz in hypertension recently published bears directly on this point, particularly as

pertains to dental foci. Among the predisposing factors considered in their study, focal infection was by far the most common. They found dental infections in 60.8 per cent, tonsillar infection in 35.4 per cent and some focus of infection in 82.7 per cent of 110 consecutive patients with hypertension, who were 45 years of age or older. Moreover, in a series of thirty-three patients under 45 years of age, dental infection was found in 60.6 per cent, tonsillar infection in 40 per cent and some focus infection in the head in 84.4 per cent.

THE PULPLESS TOOTH

The cultures from dental foci injected into animals were chiefly obtained from artifically "devitalized" teeth. In order to be certain that the bacteria isolated and injected were from these teeth and not contaminations from the mouth, in addition to control experiments with cultures from the latter, advantage was taken of the fact that the streptococcus in the saliva and gingivae grows readily aerobically and that those at the apices of pulpless teeth usually grow only under conditions of partial or complete anaerobiosis. Differential cultures were made on the surface of blood-agar plates and in the glucose-brain-agar of the apices of teeth extracted in as sterile a manner as possible. Teeth from which no colonies, or relatively few, grow on the former medium, and large, or in proportion to the amount of medium, larger numbers are obtained in the latter, especially if in the anaerobic part of the tubes, are considered infected (Figs. 1 and 3).

Thus, of 174 pulpless anterior teeth, including some that were normal in the radiogram, of which accurate records were kept, all but seven were found infected. Streptococci, which usually produced green colonies on blood agar alone or together with staphylococci or bacilli, were found in all of the positive culture. Colon bacilli were only rarely obtained. Moreover, through the cooperation of the Section on Dentistry of the Clinic, comparable results are being obtained from the apical end, resected through the window operation, before the tooth is drawn and in which the sterility of the operative field is controlled by making cultures from swabbings of the mucous membrane and of the bone after reflecting the mucoperiosteal flap. The results from these studies will be reported later. The cultural findings, together with those of Meisser, Price, Haden and others, and the many positive results in animal experiments leave little doubt that pulpless teeth, including those negative in the radiogram, are often infected and are the source of systemic disease (Fig 5). Just how often and how soon this occurs after devitalization, and the relative merits of the different methods of treating the root canal, remains to be determined. Practically all investigators agree that vital teeth free from pyorrhea and caries are essentially sterile, a fact that our results also show.

It is not difficult to understand why infection of hematogenous or other sources is so likely to occur and why it tends to persist in tissues immediately adjacent to the apical end of artificially devitalized teeth. Injury to the cementum in the operation of extracting the pulp and filling the root canal can scarcely be avoided. Filling completely the multiple formina at the apex and the finer canaliculi throughout the root substance, especially with solutions of

the hydrophobic colloids, such as gutta-percha, commonly employed, is extremely difficult and certainly cannot always be done. In extracting the highly vascular pulp, the available blood supply is greatly lowered, and in filling the canal, the highly permeable root end is converted into virtually an impermeable structure, and in this sense becomes like a foreign body subjected constantly to stress and strain and protruding through an infected tissue, the mucous membrane of the mouth. All now agree that teeth which show rarefaction about their apices are infected and should be drawn or the infected area eradicated (Fig. 6). No doubt, teeth from which the pulp has been extracted and whose root canals have been properly treated and filled and which remain negative in the radiogram may sometimes be retained for long time without apparent harm. But too much reliance has been placed on radiologic findings and on the absence of local or general symptoms in these cases. The density and depth of the bony structures around teeth vary greatly. At best, the radiogram reveals only about one-half of the area surrounding roots of teeth. The absence of local symptoms around the roots of infected teeth, as I have repeatedly pointed out, may not mean absence of infection, but instead, lack of pressure due to free drainage into lymph or blood stream of bacteria and their products, situated usually at the periphery of granulomas (Fig. 7), where new capillaries are found. Harm may be done long before it becomes manifest clinically or serious disease develops for which the pulpless tooth may be directly responsible but which is not even considered either by clinicians or pathologists. To wait in these cases for the development of a definite systemic disease before the tooth is drawn may result disastrously. A procedure that is as difficult of proper performance as work on the root canal and that carries with it potential dangers that are so insidious in their development and so difficult to recognize and so prone to do serious harm should, I believe, be used only in exceptional cases and not as a routine procedure for trivial reasons, as has so often been the case in the past. It is to be hoped that an efficient method may be found that will not only render pulpless teeth and periapical tissues that have become infected, sterile, but that will also prevent subsequent infection especially of the periapical tissues. The fulfilment of this requirement seems therefore almost impossible. Until this has been accomplished, it would seem wiser to remove teeth that have become infected or that require extirpation of the pulp than to retain them to become a source of perhaps a fatal infection later. Deplorable as it is to sacrifice a tooth, it must be remembered that patients from whose jaws all infected teeth have been drawn live a long time in good health and with well-fitting artificial dentures. The arguments that not all pulpless teeth are infected or give rise to serious systemic disease, or that results in animals are not always positive, put forth by some for the retention of pulpless teeth and for continuing the practice of devitalization and treatment of root canals, are similar to those brought forward some years ago against the idea of water-born typhoid. Only a small proportion of the population that consumed the polluted water contracted typhoid fever, and therefore the source in those that did must be other than the water. It is realized that

to attempt to extract all pulpless teeth regardless of conditions would be impracticable even though perhaps productive of much good. But on the basis of the results of the experiments reported herewith and many other facts, to extract all devitalized teeth irrespective of the radiologic findings in persons who have a serious systemic disease and when no other focus can be found, is a rational and conservative procedure, to which, if properly explained, patients will usually readily subscribe, and which in many instances, will result in the alleviation of suffering. In order to apply properly the principle of focal infection and elective localization, it must be remembered that the field covered is almost as large as that of the practice of medicine, surgery and dentistry combined; that the responsible focus may not be in the dental area; that foci elsewhere predispose to the development of infection in or around the teeth, especially around devitalized teeth, and that systemic disease is not always attributable to focal infection. Much needs to be learned regarding details, but enough information both clinical and experimental has accumulated that has been confirmed and extended by the additional findings reported herewith, that the application of this important phase of preventive medicine and dentistry will continue to bear fruit.

DISCUSSION

John Oppie McCall, New York City: In the study of cases presenting symptoms of focal infection, the oral diagnostician finds it necessary to be on the alert for the detection of other conditions that may be quite as potent a factor in producing systemic disease as are pulpless teeth. The consideration of the focal infection theory, therefore, should not be permitted to revolve solely around the question as to whether pulpless teeth can be rendered and maintained free from infection, but must take into account these other factors. In the first place, teeth with vital pulps frequently develop infection of sufficient virulence to produce metastatic effects. Under such circumstances, the radiogram will usually give an indication of the condition, although this is not invariably the case. We must remember, therefore, that the teeth that give a positive vitality reaction are not necessarily free from infection. In addition to that, we find a common source of infection in the tissues around impacted teeth. These teeth are prone to develop pericoronal infections and should nearly always be extracted. Edentulous areas are frequently found to harbor infection that has persisted after the removal of an infected tooth. These areas are difficult to diagnose, since they often register but faintly in the roentgen-ray film. A young man, aged 22, was suffering from glaucoma, a serious disease of the eyes. His vision had been reduced to what has been described as pin-point vision, and furthermore he suffered much pain. He had had several teeth extracted about six months before I saw him, and without obtaining relief. His oculist, not being satisfied with the previous oral diagnosis, referred him to me. I found an unerupted lower third molar, posterior to which there was pronounced bone rarefaction. In addition to this, the sockets from which the teeth had been extracted six months previously showed little evidence of the filling in of new bone. While this was not conclusive evidence of infection, after a six-months interval, the nature of the case was so serious that I felt justified in recommending curettage of these areas as well as the removal of the lower third molar. At operation, the sockets of the previously extracted teeth were found to contain granulomatous tissue, which was thoroughly removed. The lower third molar was extracted. Improvement was prompt and the patient progressed to as great a degree as could be expected in view of the considerable damage already done to the eyes. The patient now has a much amplified vision, is free from pain, and has every reason to expect that his sight will not be lost.

MEDICAL KNOWLEDGE IN DENTAL EDUCATION*

By Ch. F. L. NORD, The Hague, Holland

WHEN I set forth some of my views on dental education I am not actuated by the belief that I can present a new point of view on a subject that has been considered and treated for so many years and by the best and most competent authorities. It is my intention only to point out, in the smallest possible compass, why, to my mind, some international principles with regards to education are desirable and why a detailed international plan of education would be out of place.

A consideration of the interest with which dental education is talked of and written about in different countries at this moment has convinced me that the establishment of the principles alluded to here might be of importance for the development of dentistry in those countries. If this development is to be led in the right direction, good dental education is required, in the first place, that those who follow this profession may not only be able to treat their patients according to the requirements of our times, but also be able to cooperate in promoting dental science. Because of this obvious truth, for years improvement of the dental curriculum was aimed at, and national and international aid was enlisted in order that this advancement might be as great as possible.

The international dental curriculum, composed, about twenty years ago, by the Fédération Dentaire Internationale, has, in the meantime, become antiquated, and it is a question whether there is any use in substituting a new plan for it. That it is antiquated is principally due to the fact that it appeared in those years before the connection of affections of the teeth and general diseases was well recognized, and that, hence, progress must take place through an improvement in mouth hygiene, and the changes in the education of students must consist, for the greater part, in a more thorough knowledge of biology and medicine. This fact has been observed everywhere during the past ten years.

In almost all civilized countries, dental education is being discussed, and although what the dentist ought to know about the practical part of his profession is well established, there is a great difference of opinion with regard to the amount of medical knowledge that should be instilled into the student; a difference of opinion that has several times been the cause of an estrangement which has not been conducive either to the advancement of education itself, or to dentistry as such.

The question now is whether these differences are of such a nature as to form an insurmountable obstacle between advocates and opponents, and also

*Read before the Section on Dental Education at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 24, 1926.

whether an international authoritative opinion can be formulated which may serve as a basis for a plan of education that may and will have to be different for every nation. For this is to be stated: conditions of general education in the several countries differ so much both as to the nature and the duration of preliminary and university education that it would be impossible and even quite wrong to establish the same curriculum everywhere. A common basis will have to be looked for that will satisfy everyone. And this basis may be found in the simplest way by taking as a starting point the theory, not yet accepted anywhere, but in every way logical, that medical study shall be divided into a general preliminary course of education which is the same for all students, and, after this, a specialized study, so that, besides the general medical practioner, there will be the specialist for ears, nose and throat, an oculist, a surgeon, etc., who will be licensed to practice only within the limits of the speciality for which he has been trained.

Supposing this condition to be reality, there is probably no one who would object to a course of study which, as with the surgeon, would offer the oculist and the dentist an equivalent preliminary education and special study succeeding it; for such a curriculum would guarantee that both requirements were fulfilled: efficient general medical education and sufficient specialized dental training.

If this point of view is accepted, it follows, in the first place, that the requirements for admission to the study of dentistry should equal the requirements of the medical specialist; in other words, that the preliminary study will have to be the same throughout. After this, the most practical way to approach the ideal will have to be outlined for each country separately; and this brings up the question: how can the student, without too much loss of time and money, acquire sufficient medical knowledge, without his technical education suffering from it?

This is possible (1) through an entirely separate course of education in dentistry in which the medical phase of the study is taught specially for dental students, and they therefore receive only that which is necessary and useful for them; (2) by an educational course in which the dental and the medical students are taught together during the propadeutic years, and pass the same examination, to follow the study of their chosen profession afterwards; (3) by permitting the dental student first to complete the entire medical study, and then to begin his dental education, or to avoid loss of time by giving the student an opportunity during his medical study to begin his purely dental education.

None of these three possibilities should be rejected without due consideration. The first, as long as the ideal has not been attained, is presumably the best, but at the same time the most expensive. It will be applied where tradition makes this solution possible and finances admit of it.

The second will be considered where dental education is given at a university and medical teachers are therefore present. It can be realized only when medical instructors are prepared to give their assistance wholeheartedly, so that attendance at colleges and clinics that are of little or no value to the dentist may be avoided as much as possible.

The third solution may be considered in those countries where medical

study does not require too much time and where, for certain reasons, the acquiring of the necessary medical knowledge is impossible in any other way. It is always preferable to a course in which a lack of that knowledge would have to be stated; for, although technical education must most decidedly not be allowed to suffer, everyone will agree that, considering the actual condition of science, a dentist with insufficient medical knowledge may become a danger to his patient, while, at the same time, he becomes unfit for keeping up with the eventual progress of his profession, much less for contributing to it.

How much scientific education is an essential condition for this progress may be evident in dentistry, in which, even in the purely technical, prosthetic phase, all improvements have come from the dentists; the thousands of dental mechanics, however capable, failing, because of insufficient education, to institute any improvements of importance. By this, I do not mean that the tendency to attach too much importance to the medical phase and to consider the purely dental manipulations as something of less consequence should not be opposed. The group that has held this opinion hitherto forms a small minority. Which ever of these three possibilities are finally accepted, it may be stated that, for this study, a period of five years, or as much longer as the condition in the country in question shall require, will have to be considered as a minimum.

SUMMARY AND CONCLUSIONS

1. In order to facilitate the attempts at improving dental education in the various countries, it is desirable to evolve general principles for planning a dental curriculum.

2. It is not advisable to recommend a detailed educational plan for international use.

3. In every country, the requirements for admission to the study of dentistry should be the same as for admission to the study of medicine.

4. Most desirable would be a special medical course not covering all the qualifications for the practice of medicine, and to which the study of dentistry would be added. As long as this is not the case, it should be seen to that, in the dental curriculum, the medical knowledge of the student approaches this end as nearly as possible. This may be accomplished by: (a) employment by the dental school of a sufficient number of medical instructors; (b) attendance of dental students at the university with the medical students for the medical propadeusis, and further attendance at such colleges and clinics as are of importance to the dentist; (c) an entire medical curriculum with sufficient dental education.

In whichever way the education is made possible, a five year curriculum will have to be considered a minimum for dental education.

REPORT OF A REPLANTATION CASE*

By J. R. BLAYNEY, B.S., D.D.S., Chicago, Illinois

MUCH has been written concerning the success or failure of replantation cases. This report is given in an effort to add another bit of evidence to support either the success or failure of the procedure, as the reader may determine for himself.

REPORT OF CASE

In May, 1920, a boy, aged 10 years, fell against the edge of a school desk, knocking out the permanent upper central and lateral incisors and the deciduous upper cuspids. Frightened by the accident, he immediately ran home, but, later in the day, his mother had him return to the school room and secure the teeth.

The following afternoon, he came to the dental infirmary of the University of Illinois for treatment. His mother, who accompanied him, brought with her the six teeth, which she removed from her coin purse and gave to me. After an examination, the patient was dismissed with instructions to return the following morning. The pulp chamber of each incisor was opened through the lingual surface, the pulp tissue thoroughly removed and the root canal filled with guttapercha. Bracket bands were then adapted to the crowns, and the teeth were placed in a saturated solution of boric acid and allowed to remain there until the following morning. At this time, anchor bands were placed on the upper first permanent molars; a ribbon arch was adapted to fit the case, and the bracket bands were cemented to the crowns of each central and lateral incisor. The anterior portion of the maxilla was anesthetized with procain to permit the removal of the blood clot that had formed in the socket. Each tooth was now placed in its respective socket and firmly but gently held in position by the ribbon arch.

The radiogram that was made immediately after the replantation has been lost. Figure 1 illustrates the condition of the case one month later. A careful examination of the film shows that absorption is beginning at the apex of all four teeth and also that there is a small area of absorption on the distal surface of each lateral root in the region of the cuspid crown. The films in Figure 2, made about six weeks later, show how rapidly the absorption of the lateral incisors is progressing.

Figure 3 depicts the condition four months after replantation. Pressure caused by the developing cuspids is undoubtedly responsible for the rapid destruction of the lateral incisors.

Figure 4 shows the condition one year after replantation, and Figure 5 shows the right lateral incisor, which came out shortly before the patient returned for the films shown in Figure 4. Clinical examination revealed that the left lateral was quite loose, so it was not expected to remain in position much longer.

After this examination, in June, 1921, the patient failed to respond to all requests to return, so the case was given up as lost. In September, 1925, he unexpectedly returned to the clinic and, much to our surprise, both centrals were in position and quite firmly fixed.

*From the Department of Materia Medica and Therapeutics, University of Illinois College of Dentistry.

Figure 6 shows a photograph of the mouth; Figure 7, a plaster cast, and Figure 8, a radiogram, all made at this time. In spite of the fact that the last radiogram indicates absorption of all the root portion of each central incisor, the crowns are firmly fixed. The cuspids are completely developed and in fairly good position, although they have moved forward 2 or 3 mm.

Fig. 1.—Condition of case, one month after replantation.

Fig. 2.—Condition of case, two months and a half after replantation. Rapid absorption of the lateral incisors is evident.

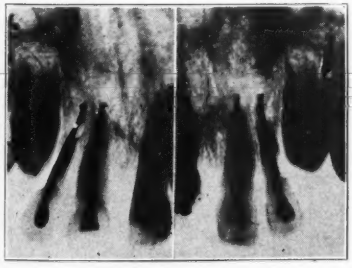

Fig. 3.—Condition of case, four months after replantation. Pressure from the developing cuspids is undoubtedly responsible for the rapid destruction of the lateral incisors.

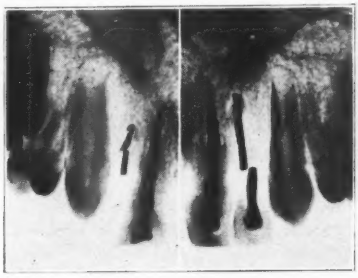

Fig. 4.—Condition of case, one year after replantation.

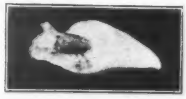

Fig. 5.—Right lateral incisor.

Fig. 6.—Appearance of mouth after four years had elapsed.

Figure 9 is a recent film from a case in which the pulp was removed and the root canal filled with the tooth *in situ* in 1920, about the time that the teeth were

replanted in the first case. It is evident that absorption is not taking place in the

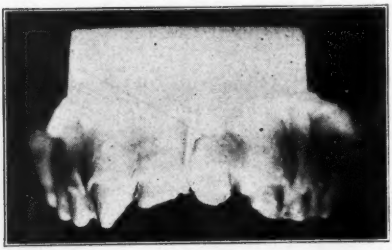

Fig. 7.—Plaster cast made at the same time as the photograph shown in Figure 6.

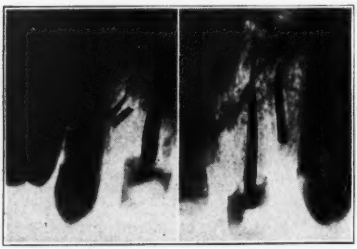

Fig. 8.—Film taken at the same time as the photograph shown in Figure 6.

case illustrated in Figure 9. These two cases clearly illustrate the different type of tissue reaction which occurs in the case of a dead tooth and a pulpless tooth. I have under observation other cases quite similar. In these, the teeth were

Fig. 9.—A case in which the pulp was removed and the root canal filled with the tooth in situ. It is evident that absorption is not taking place.

broken in such a way as to expose the pulps, the teeth being extremely loose but still in their sockets. The outcome of these cases will be reported after the elapse of an equal amount of time.

DENTAL SERVICES IN EVACUATION AND COMBAT ZONE HOSPITALS*

By WILLIAM C. SPEAKMAN, D.D.S., Wilmington, Delaware

PREPARATION for an emergency depends entirely on oneself. The dental service at an evacuation hospital, or a surgical hospital in the theater of operations, or at any hospital for that matter, is now, as it was in the past and will be in the future, just what the dental surgeon makes it. If he is ingenious, not afraid to work, keeps his eyes open for the things in which he can make himself useful, he can accomplish much.

The mission of the medical service, of which the dental service is a part, is, first of all, to keep men at the front; secondly, to save lives, and thirdly, to send men back to civil life with the least possible disfigurement and the least possible drain on the government, our institutions and the family or friends of the wounded man.

During the latter part of 1915, I often sat with William S. Davenport, one of the ablest men we have ever had, in war or peace, in his office in Paris and discussed the problem of reducing facial disfigurement to the minimum. We agreed that there should be a trained dental surgeon stationed at the hospitals that first receive the wounded, in order that every particle of the savable tissue might be retained and the patient have such skilful attention as a trained dental surgeon is capable of rendering, to insure more nearly ideal results. When I returned to this country late in the same year, good fortune brought me in contact with Surgeon General Gorgas and his staff, with whom I went over the problem, pretty thoroughly, without, at the moment, the slightest idea that we were to take part in the World War.

The lessening, so far as possible, of facial deformity is accomplished in two ways: first, by saving all savable tissue either osseous or connective, and here the aid of the dental officer at the front comes in, and, secondly, by use of supporting mechanical fixtures, over which the facial surgeon may perform his part of the restoration; and here the assistance of the clever mechanic comes in.

During the World War, we had battalion aid stations, the regimental stations, the field hospital, the mobile hospital, evacuation hospitals, base hospitals and then the hospitals back in the zone of the interior. All of you who were in service are familiar with these. In the present system of things, the organization is just a little different, and probably much better. We commence with the battalion aid station, as we did in the late War, and somewhat to the rear of this is the regimental aid station. Wounded from these two

*Read before the Section on Military Surgery at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 24, 1926.

stations are carried back; stretcher cases transported by carriers, slightly wounded walking or guided, to a protected spot, if such is available, where the animal-drawn ambulance can be taken; or to available roads, by which they are transported to the collecting stations. They are then transported to the sorting station, the *triage* or mobile hospital of the late War. The name *triage* is being retained; the name sorting is, for certain reasons, not so popular.

From the present so-called sorting station, they are transported to the division hospital and to the surgical hospital for immediate and necessary operation.

From there, the cases are transported to the hospitals in the rear, by ambulance generally, or there may be occasions where the rail head may be used.

Slightly wounded patients, available for service within a few days, may probably never be sent to the rear of the evacuation hospital; very slightly wounded, probably not to the rear of hospital stations; it being the present system of things to retain men with their outfits as much as possible.

Probably, a dental officer is not particularly useful at a battalion or regimental aid station, and probably not at a collecting station, but he assuredly is at an evacuation hospital and at the surgical hospital in the forward zone. I am referring to the hospitals of the division.

Probably, this is where he fits in first, and at this particular point, I desire to emphasize that a trained dental officer who is clever can be of great service. If he is a skilful man, the personnel of the surgical hospital will recognize his ability and depend on him. Just here, I might say a word about his procedures and his equipment. It was fast becoming the rule not to be in a hurry to remove particles of bone, even the much shattered portions which are attached to connective tissue; for experience proved that even small particles were capable of throwing out new bone cells and at times bridged over rather amazing distances. (The *Maxillo-Faciale* service at Val-de-Grace have some remarkable records which I had an opportunity of seeing and which further confirmed my belief that it was well not to be in a hurry to remove particles of bone.)

This frequently saved a lot of bone grafting and, in time, gave support, in some measure, to artificial appliances over which operations were performed for the reconstruction of facial contour.

That fractured teeth are to be removed goes without saying; generally, all teeth in the line of fracture. I found a small light malleable metal bar with its little lugs, similar to the Baker bar, ligated into place on the largest remaining parts of the mandible, or to the teeth rather, with soft annealed brass wire, then slowly drawn into place with very small rubber bands, most useful and remarkably pain relieving to the patient.

Here, I might describe a rather ingenious scheme which originated, I think, among the English: that of sewing the hooks from a card of hooks and eyes, on a strip of canton flannel, the hooks on the smooth side, the size of the strip and the shape depending on the case on which it was to be used, and applying this strip of canton flannel with its hooks to the face, say one strip above a wound with the bent part of the hook downward, then another strip with its hooks applied to the face

below the wound, with the bend of hooks upward. Then, a lacing of almost any ligature, laced somewhat like the old-fashioned lacing of a shoe, would support the mutilated tissues in a more comfortable position. Each day, the lacing would, I understand, be cut; the underlying tissues washed, and the parts relaced. This was to support the tissues until the underlying structure was built or the bone properly supported. Then the margins of the wound could be freshened and sutured.

The strips of canton flannel were cemented to the face above and below a wound with a glue made up of mastic, 15 gm., Canada balsam, 2.5 gm., and sulphuric ether, 15 gm.

It was not thought, and is still not thought, a wise practice to suture facial wounds immediately, surely not if the mutilation is great, involving the bone structure underneath. Times without number, early suturing played havoc with the reconstruction of the framework beneath, on which the final contour of the face so much depends. There are times, of course, when so much of the bony structure has been shot away that practically an entire artificial framework must be constructed, over which the plastic surgeon may operate; but even in these cases, I contend that it is far better not to suture the soft tissues until the frame work is in place. Those of you who have seen the mechanical constructions of Maj. V. H. Kazanjian, who was with the British at Base Hospital No. 20, will appreciate the possibilities of the underlying framework.

This work, of course, can be accomplished only in the hospital centers and has nothing to do with the subject of this paper.

As to equipment, the simpler it is, the better. At the present moment, Maj. John Fletcher, of the Medical Corps, is working at Carlisle Barracks on equipment, not only for the Medical Corps, but also for the Dental Corps. As I say, the simpler and fewer the instruments, the better. Every dental surgeon has a few pet instruments which are to him almost absolutely necessary, and there is no objection to his using them to supplement any standard equipment which the medical department may issue. But there are a few things which to my mind are indispensable:

Soft annealed brass wire, No. 26 & 27.
Lane pliers.
Broad nose hematic forceps.
Tissue forceps.
Dressing forceps.
Mouth lamp which can be attached to battery or cells.
Ordinary mouth mirror.
Ordinary pliers.

These, to my mind, are sufficient to accomplish many operations. Bandages, gauze pads, cotton and all of the necessary hospital supplies he will, of course, find wherever he may be stationed. Beaver board which can always be found, when softened in hot water and allowed to dry fastened to a round or oblong vessel or molded about chins of several sizes, is most useful. Here let me say that we should never tightly bandage a fractured mandible. All these patients are far more comfortable if the jaw is supported to about the normal position and not bandaged tightly, especially if the patient has to be transported by ambulance or train to a center where he is to undergo further treatment.

As the nose will not infrequently be involved in gun-shot wounds of the face, it too comes in for its share of

support in the front line of service. In one simple method of support, ordinary beeswax or the so-called base-plate wax is melted around large goose quills, and is shaped to what is about the normal shape of the nostril. These quills, with the adherent wax, are placed in the nares; torn fragments are gently put into place; two holes are cut in a half inch strip of adhesive plaster, probably an inch or an inch and a half apart; and the two ends of the quills are run through these holes, the wax keeping the quills from coming out. The ends of the plaster are then carried a bit upwards and backwards to the cheek, and applied.

In another method, the ordinary electrician's solder, which is in the shape of a soft heavy wire, is attached to a headband made of any tin or beaver board.

We must bear in mind that a dental officer serving in the combat zone has not the means of transporting much equipment; nor has he a laboratory at hand in which he may make elaborate appliances, and ready-made fixtures do not always answer his purpose. He must rely on his mechanical ingenuity, with which, as a rule, he is generously supplied, and it is but second nature for him to contrive temporary appliances for each and every case.

Now comes an important service to a wounded man, that of his nourishment. With the lower part of the face badly mutilated, with the neck involved in many cases, swallowing of food, even liquids, in the normal way becomes very difficult.

I learned feeding through the nose from a clever nurse, a Miss Stahl, who was attached to Base Hospital No. 20, where I saw Kazanjian at work. In fact, she was keeping several of Kazanjian's patients alive. She used a soft rubber catheter, of several sizes, which she introduced, rounded end first, into the nose, gently, allowing it to pass backward, following the air passage until the end reached a bit below the soft palate. Her patients soon learned to assist her, and with a look or nod indicated to her when the tube had reached a comfortable place. In the outer end of the tube she inserted a small porcelain funnel into which she slowly poured, a swallow at a time, water, milk, beef juice, orange juice, clear soup, anything in the way of liquid food that she was able to obtain. I resorted to this method of feeding on several occasions, going to our camp kitchen and skimming juice from the cooking vegetables or meat, and often when I could obtain them, I used eggs and milk beaten together. It was remarkable how quickly the patient learned to take nourishment in this way. In transportation, he may, by means of his rubber tubing, have access to a regular pantry of liquids.

A vital thing the dental surgeon had to contend with, and the bane of us all, was secondary hemorrhage. As you know, there is no standard method of its control; no two cases are alike. The only rule that one might give is: watch the patient carefully until the danger is past and disturb the tissues as little as possible. Even then, with the greatest care, the tissues may slough to a secondary hemorrhage.

As to personnel: On the evacuation hospital falls the brunt of the preliminary care of battle casualties. They are the keystone of hospitalization in the combat zone. Evacuation hospitals are virtually the neck of the funnel through which all casualty cases coming from

the front must pass in their dispersion to the rear. In them, *triage*, or sorting, becomes important. Each hospital has a normal capacity of 750 beds. Army bulletin No. 12 says: "Every regimental surgeon has ideas of his own as to how the limited personnel and equipment provided him can best be distributed." This matter is always left to his discretion. I take it as so with the division surgeon. Thus, the personnel depends largely on the extent of the operation in which the division is engaged. The dental officer will have assigned to him such assistance as may be necessary, and he will always have a skilled specialist with whom he may operate. He will, of course, work in conjunction with the surgeons; and as I have said, if he manifests cleverness, he will find plenty to do, and the personnel assigned to such a hospital will be at his disposal. All this may be gleaned from Army Medical Bulletins Nos. 12, 13 and 14.

The dental surgeon should become fully acquainted with the field kitchen and should familiarize himself with the preparation of nourishment, especially of liquid food. Diet kitchens that may be quickly installed in trucks have been developed, and these go forward as far as the collecting stations.

To repeat: The mission of the Medical Department of the Army is to keep man power at the front. There may come to our hands a wounded man, but wounded so slightly that twenty-four hours' care will make him good as new. He may be a skilled gunner from the artillery; he may be a skilled scout or patrol; he may be a man on whom the company officer depends largely. I have seen cases of fracture of a few teeth in which, after removal of the roots and simple treatment, the patient was quite able to return to his outfit. He need not go to the rear. Then, there are cases of Vincent's infection, which, painful though they may be, can well be attended to at the front and the man retained. It goes without saying that the dentist comes in contact almost daily with dental disorders. I need not dwell on these cases.

A dental officer should familiarize himself thoroughly with administration. He should know army tactics, regulations of the medical service, the organization, equipment, functions and principles governing the medical regiment. The correspondence courses go a long way toward familiarizing one with everything that may be expected of him. Then there are the periods of lull or quiet with which so many of us are familiar. Is the dental officer to rest upon laurels won by strenuous duty during an attack and loaf during quiet intervals?

If an energetic man and wedded to the ideal of being of assistance in maintaining components of the army in normal conditions, he will find many opportunities to service if he has the welfare of the men at heart. There is always need for dental service, and his contribution to the general welfare will be just as he wishes to make it, either during combat, or while the army is at rest.

THE VALUE OF ORTHODONTIC EXPERIENCE IN GENERAL PRACTICE*

By ALFRED C. LOCKETT, London, England

A GENERAL practitioner of dentistry for, say, twenty years will frankly admit that, were it not for variety of work in the daily effort, his life would be narrowed down to a disheartening monotony. As general practitioners, we change from one type of work to another and, with repeated changes, a week's work is relieved of that monotony, and becomes sufficiently interesting at the end of the week to create interest for the succeeding week. The tendency in general practice in America, of late years, has been to specialize in this or that branch of our profession. There is a good deal to be said for that tendency, and perhaps little can be said against it. In Europe, there is not the same tendency, and I question very much whether there ever will be. In America, specialization in orthodontia has put this branch of dentistry on a footing that no power on earth can dislodge. The past twenty-five years has established orthodontia as a specialty, and this specializing has done more for the subject in some respects than could have been done without it. It has definitely proved that, on matters of principle, a great deal that was thought sound and right is unsound and wrong.

*Read before the Section on Orthodontia at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 23, 1926.

The chief and natural object of orthodontia has been the correction of malocclusion. If specialists had been fortunate enough to find that all corrected cases of malocclusion, with a reasonably short period of retention, would remain corrected, their lives would have been full of contentment and happiness in having transformed a vast number of cases of irregularity of the teeth, into perfect occlusion, accompanied by such changes in expression and facial characteristics as would constitute results that bring joy to the parents, the patient and the operator.

I can think of no more pleasing and encouraging branch of work in any profession than orthodontia if hopes had become realities. Most of the earlier specialists took up this work with a feeling of certainty of results. They abandoned general practice to live this life of joy and satisfaction, with the certain intention of serving humanity and making people happy in doing for them with thoroughness what the dental profession had in past years done in an uncertain manner.

At the completion of what was then the best and only recognized course in orthodontia, in 1905, inexperienced as I was in general practice—just a graduate—I had some very serious doubts about the final results in adult life of the cases treated. I was satisfied that a

malocclusion was capable of being transformed into a normal occlusion. I never had any doubts about that. The whole subject, however, was enshrouded with so many mysteries and staged in such a manner as to create in my inexperienced mind an element of doubt. All the beautiful staging seemed at that time so unnecessary on what appeared to me to be a straight forward operation involving a certain amount of time, work and care.

The years have gone by. Teaching has been put into practice, by most men, with normal occlusion as the preliminary result. The great hopes that I referred to have dwindled to a point that most of us never dreamed of, and we are now engaged—specialists and general practitioners interested in orthodontia—in working out the causes of the disappointment brought about by the lapsing of beautiful results in cases of malocclusion again.

I am presenting this paper with the object of enrolling your sympathetic consideration and cooperation on one particular aspect of this subject, and I hope to succeed in arousing your interest on behalf of the orthodontic profession in Europe, and especially in England. We in Europe are greatly indebted to your prominent orthodontists and teachers for the help that they have given us in past years, and we are counting on more help in years to come. It is not for me to suggest to them what the value of help from general practitioners means to orthodontia. I am convinced that you who may or may not specialize in orthodontia, but who are all engaged in the practice of dentistry, can do a great deal to help us solve our orthodontic problems in Europe, and I hope to see the day when Europe can and will help the practice of orthodontia in America, whether it be practiced as a specialty or as a branch of general dentistry.

My chief topic is the lapsing of treated cases. My remarks must not be looked on as a criticism of other men's efforts and work. This serious question of lapsing of treated cases into malocclusion has forced itself to the front, to such a conspicuous position that all must face it. It is perhaps the most unpleasant feature of the orthodontic problems of today. It reminds one of unpleasant memories, and we wish that we could pass over it and forget it. We can do so if we wish, but it will soon return and present itself again in a more conspicuous manner. I determined to face it three years ago, and to do my utmost to try to examine this problem with every society I could reach, and keep it at the front until we know that practicing orthodontists and others interested in orthodontia have determined that satisfactory results in adult life in treated cases may in future be assured. The lapsing of treated cases has held a prominent place before the International Orthodontic Congress just held in New York.

In Europe, we are of opinion that some of the most sacred ideals of orthodontia must be sacrificed if that is found to be the only hope of establishing permanent results. I believe that general practitioners interested in this subject, and who treat cases in their practices, can now, and in years to come will, throw a good deal of light on this aspect of dentistry and, as one of your body, I have brought the subject here to ask you, on behalf of your own problems and particularly those of Europe, to help us to work out reme-

dies that will enable all practitioners of orthodontia to attain an assured result.

The greatest value of orthodontic experience in general practice is to be found in the part we can play in assisting our specializing colleagues in the solution of the orthodontic problems, and particularly so with reference to lapsing of treated cases. I shall endeavor to suggest to you: (1) some of the methods and means by which this can be done; (2) some of the reasons why our contributions of ideas can be most helpful; (3) some of the disadvantages of specialization—admitting as I do, that specialization has many great advantages; (4) some of the principal features which should be considered in the interests of the parents and patients, both of whom ought to receive fair consideration in these cases; (5) some of the conditions which must arise in all countries and nationalities among people who may not be fortunate enough to obtain the services of a specialist. All these conditions must be considered if the treatment of cases is to receive attention in a truly national spirit, and not be confined to the fortunate few.

METHODS AND MEANS

To play the helpful part we are capable of, it is necessary that an operator who intends to practice orthodontia fortify himself by taking a recognized course of study and technic to fit him for carrying on this work. To this must be added a regular system of reading and improving the many opportunities of increasing the breadth of vision by visiting clinics and by membership in orthodontic societies. An operator will soon find that all these opportunities will create a wealth of interest in this interesting specialty or branch of his practice. When that interest is created, it will not subside.

I can think of no better means of contributing to the problems of orthodontic practice than, first of all, becoming a disbeliever. Take the stand that, with the best of intentions on the part of a tutor or essayist on matters of principle, he may be wrong, and go out to prove that he is, or that you are wrong. On matters of technic, tutors are not often wrong, though the technic may present some features that it may prove inadvisable to use. Mechanics prove or disprove their usefulness. The principal reasons today for the lapsing of treated cases may prove to be the following:

1. It takes years to prove that what may be considered an underlying principle in the practice of orthodontia is sound and incontestable. In like manner, it takes years for a disbeliever to prove that a principle or idea is not sound.

2. Hard and fast principles and methods of treatment have been laid down for all peoples, of the same race and of different races regardless of type.

3. There is often failure to visualize what a treated case will look like in adult and late life.

4. There is a lack of appreciation of the power and force of erupting second and third molars in treated cases in conjunction with the particular type of individual under treatment.

5. Undue importance is laid on the part that the usually recognized forces governing occlusion play in undoing treated cases, and a failure to recognize the fact that, in a great many instances, these forces are beyond the control of

the operator, and that efforts to restore them are not practical.

6. Certain methods of treatment are adopted without assurance of the opportunity to carry the plan to its final issue. It is useless for an operator to embark on a plan unless he is assured of the opportunity to complete it.

7. Parents and patients fail to cooperate with the practitioner.

8. Some cases do respond and give the results that were expected, which may be due to the skilful manner in which the operation was carried through in all its stages. Comparison of such a successful result with an unsuccessful result, and one treated in a similarly skilful manner by the same operator, suggests that some or all of the causes that brought about this particular condition of malocclusion may have been overlooked. Nevertheless, there are so many of these lapsing cases in adult life that, in many instances, the treatment of a case of malocclusion seems to be a fight against the principle of evolution. Whether this idea is sound or not, the fact remains that much time and effort are expended in fighting against forces which are apparently unsurmountable, and up to the present time, baffle everyone.

The theories and experiences of the general practitioner are helpful because

(*a*) The general practitioner has opportunities to see the results in treated cases in later life, and also the effect on all the structure of the mouth. He can trace the effect of the use of different appliances on the teeth and the soft tissues. He can point out where this or that appliance has done harm, serious or slight, and can determine whether prolonged treatment has advantages over a short period of treatment. Also whether the patient in the end has gained much or little in having the case treated.

(*b*) He can see cases of irregularity developing early in life and take simple steps to prevent its becoming a serious irregularity. He will also see cases of apparently normal occlusion at 10 and 11 years become cases of irregularity at from 12 to 20 years. He will see corrected cases in hundreds return to malocclusion in various stages of life. If records of a large number of these cases were taken, and sent to the operator who performed the work, not as a criticism, but as a contribution for study of results and causes, we would soon get at the truth of this problem of lapsing cases, and find a cure.

(*c*) He would soon be able to offer proof that the generally accepted belief as to the retention of all the temporary teeth in all cases of irregularity is not a sound principle where normal development is taking place, and that the removal of some of the temporary teeth in cases of abnormal development and existing irregularities is often helpful in treatment, with the use of appliances in some cases, and without appliances temporarily.

(*d*) He could offer proof that pyorrhea is caused by the use of some appliances, or that it is not.

(*e*) He can get a breadth of vision and experience on many of the points that I have raised, and others I have omitted, which he alone can contribute as a result of the opportunities he possesses of studying the many phases of this interesting subject.

(*f*) He is in a position to make observations and a study of the interesting question of the value of diet on temporary dentition, and the develop-

ment of the jaws and the alveolar processes.

(*g*) He can, better than anyone else, provide proof of instances in which imperfect occlusion is a cause of local periodontal inflammation resulting in many cases in marked symptoms of pyorrhea. He can also offer proof that this theory is overdone, and that pyorrhea may not be due to orthodontic treatment.

(*h*) He will have, in years to come, an excellent opportunity to prove that rapid treatment in conjunction with retaining appliances is better or worse for the patient, than long protracted treatment with periods of freedom from treatment; in other words, whether purely mechanical devices are capable of giving better or worse results over a short period of treatment, than over a long period, carried out in conformity with the laws of growth and development as we understand them in the light of our studies and experiences.

(*i*) Last, but not least, he will materially help the profession as a whole, the world over, to decide the vexed question of the principles of treatment:

(1) Whether one set of principles can be made applicable to all people of one nationality, or there is to be a principle for the rich, one for the middle class, and another for those who constitute the backbone of the nation.

(2) What those principles are to be, either treatment on the normal occlusion basis, or treatment by the aid of extraction of some of the permanent teeth.

(3) What part of the incentive to the manufacture and sale of appliances and materials in connection with the treatment of cases plays in dominating the practice of orthodontia. No one realizes more than I the value of appliances and mechanics in orthodontia. At the same time, I have an honest conviction, as a result of years of observation, that one of the underlying causes of most of our setbacks in past years will be found in the fact that theories have been advanced as principles of treatment, when, as a matter of fact, they have merely served the purpose of proving the value of this or that type of appliance. Honest and well-intentioned practitioners have placed these appliances on the teeth of children without seeing the writing on the wall, but, today, they are well aware of the fact that they have spent years of their lives in subserviency to an appliance, when they honestly believed they were working out a principle based on a sound footing for the good of their patients and for the glory of orthodontia.

I regret that years of practice of orthodontia has created this conviction in my mind. I have tried to argue against that conviction; but instances have been so numerous that I feel it is only honest to confess it.

DISADVANTAGES OF SPECIALIZATION

The strongest argument in favor of specialization will be found in a comparison of the present manner in which excellent work is done by the specialist and the working technic of the days before specialization.

The disadvantages are few. The greatest to my mind is the absence of opportunity of seeing and studying the final results in adult life of treated cases; and next the tendency to look at this interesting subject in the light of occlusion only, missing thereby so many of the other interesting aspects of the welfare of patients and the success of the case.

THE INTERESTS OF PATIENT AND PARENTS

The contributions of value to orthodontia under this heading are not confined to the general practitioner, but the opportunities he possesses over a number of years of work for patients who have been previously under treatment are so many that it is fair to assume that, if these opportunities of contributing suggestions are embraced and acted on, the profession will benefit greatly.

CONSIDERATION OF NATIONAL PROBLEMS IN ORTHODONTIA

This side of the orthodontic problem has so far never been earnestly considered by a large body. Specialization is, to a large extent, confined to a small percentage of the population of all countries. It will continue to reach only the fortunate few. It will probably, in years to come, reach a higher percentage in America than in other countries. The practice of orthodontia, as taught today, admirable in many respects, will never touch more than a fringe of European populations. We are compelled, therefore, as general practitioners of dentistry, to face this problem, if we are to be of any real service to that part of our population which at present is unprovided for. It is a gigantic problem, and is most serious when we think of taking steps to solve it. The subject of itself is large enough for a paper, and it can only be referred to as a matter which must be considered later. The fact remains that, inasmuch as this feature must constantly be in evidence in our daily work, the time has come when we, as general practitioners, must work out some sort of school of thought which will, sooner or later, become a school of action, for dealing with so many of our people who are crying out for help, which, up to the present, has not been given them.

CONCLUSION

The consideration of European orthodontic problems is not entirely confined to orthodontic societies in Europe. It is true that there are in existence, at the present time, national orthodontic societies in different European countries which meet once a year, and, in some cases, oftener. We have endeavored, since the end of the Great War, through the agency of the European Orthodontological Society, to enlist the cooperation of all national orthodontic societies and other dental societies. In doing so, we have succeeded in having four annual meetings in Europe, which have been fairly successful. We have also been materially helped by many of the prominent specialists from America. They have been good enough to grace our meetings with their presence and have made valuable contributions, and we are deeply grateful to them for their help in this respect. We are anxious to leave no stone unturned in seeking additional assistance, and I hope that all here who may not be specialists will sooner or later attend some of our annual meetings in Europe, and give us the pleasure of seeing you and of receiving the benefit of your experience in treating cases in a general practice. There is much in common on this subject which has, so far, not been thoroughly explained. I have endeavored to point out where I think we general practitioners can be of value to the orthodontic specialty, and I hope my suggestions will be received in the spirit in which they have been made.

We in Europe who are interested in this work look forward to the day when we can have a great body of you attending our meetings. I believe that the best and earliest opportunity you will have will be at the meeting of the European Orthodontological Society in London next year, at a date to be announced later. Please join with us in making this meeting a success. Bring your experiences and your difficulties and put them on the table with ours. You will not only receive a hearty welcome, but also will find that there is among us in Europe a good deal of fellow feeling in this matter of treating orthodontic cases in a general practice. It must be done in all parts of the world, in Europe, perhaps, more than in America. The difficult conditions under which this work is performed in England, and the great need for a big effort to enable the profession to supply the help that so many children require will, I feel sure, appeal to your sympathy.

At a meeting such as I have described, you will find a large number of men who are prepared to approach the problem of treated cases that lapse into malocclusion in a broad minded way, and to study it in all its phases, with the object of making it possible to assure results. Any meeting of earnest thinkers and workers which could, in years to come, point back to the day when the element of uncertainty and doubt had been materially removed from the practice of orthodontia would be a historic assembly, and one which would never be forgotten.

DISCUSSION

Rodrigues Ottolengui, New York City: When Angle gave us his classification of malocclusions, he erected an important standard upon which to base treatment, and opened the door to the solution of many orthodontic problems. Many more cases are now successfully treated than had ever been so treated prior to that date. Is not the corollary evident? What we require now is a more complete knowledge of the lapses that occur. May not this be acquired by an intensive study of such cases, with a classification of the same, if such a term would be adequate? Classification, in the true sense, may not be applicable, but suppose that, at least, we could know: 1. In what types of cases lapses are most frequent. 2. In what direction these lapses occur. 3. To what extent, and in what types of cases the lapses are a retrogression in the direction of the arrangement, or disarrangement of the teeth, as recorded in the original study models. 4. To what extent the lapses are a progression toward the type that the cases would have attained if not treated. There are many other subdivisions of this study that would become apparent as the research progresses, but those above enumerated seem to be fundamental. Why do I allude to certain lapses, as retrogressions, and to others as progressions? As an example of a retrogression, I would cite many cases in Class 1, where the arches are abnormally narrowed across the molar and bicuspid regions, with a consequent jumbling of the anterior teeth. Here, we find a mechanical response to a causative factor, bringing about a definite placing of the teeth. The molars and bicuspids are too close together across the arch. They often assume a locked cuspal relation, before the arrival of the cuspid teeth, which are consequently crowded out. The incisors also are jumbled, assuming definite positions dependent on their shapes, and the order of their eruption. Is it not manifest that, unless the correction of such a case eradicates the cause of the malpositions of the molars and bicuspids, these teeth must eventually revert to their narrowed arches, and is it not inevitable that the anterior teeth will reoccupy exactly the malpositions which they assumed under similar stimuli in the first instance? This and similar cases are what I mean by retrogressive lapses, because the malposition of the teeth had already been decided prior to treatment, and will be resumed unless the causative factors are recognized and controlled. This is a lapse, due mainly to mechanical laws, the biologic factor being, of course, of corollary importance. The lapse which is a progression towards

type is a biologic rather than a mechanical problem. It is a result of the continuation of the growth of the jaws in the direction of a congenital type, or, let us say, a type which is a result of prenatal conditions. In such cases, treatment is rather an interruption of development than a dependable correction of malocclusion, though I do believe that, with a better comprehension of the biologic factors, treatment may be of such a character that a more permanent result might be obtainable. As an example of a lapse which is a progression toward a preconceived type, by which I mean a type preconceived by the cell elements of the jaws and facial bones, let me cite cases in Class III. In the past, too many of these cases have been treated upon the principle that they are the result of overgrowths of the mandibles; whereas, the vast majority of them are due to sluggish, or rather subnormal development of the middle third of the face. Instead of being mesial occlusions of the mandibular teeth, they are really distal occlusions of the maxillary teeth. Instead of treatment being an attempt to force the mandibular teeth distally, treatment should aim to move the maxillary teeth mesially. Lapses, in extreme cases, are partly due to the fact that the mesial, or, let us better say, forward, movement of the maxillary teeth should include a forward movement of the entire middle third of the face, such movement being often impossible. But the secondary, and really determining, cause of the final lapse is the biologic factor. The period of treatment is merely a period of interference with development, such interference not being capable of overcoming the inherent growth tendencies of the cells. To be more explicit: the mandible is developing at a normal rate, which, for the sake of clarity, we will express numerically as 100 per cent development; that is to say, 100 per cent development as compared with the development of the entire individual. But the maxillae are developing subnormally. Let us make the numerical index 80 per cent; that is to say, the maxillae are developing at the ratio of 80 per cent in comparison with the rest of the body. The result in untreated cases must be a deformity which appears to be a protruding chin, but which really is a retrusion of the middle third of the face. Treatment, in attempting to drag the mandibular teeth distally, temporarily retards the development of the lower arch, perhaps. Coincidently, the traction on the maxillary teeth stimulates the development of that region also, perhaps. Whatever occurs, the orthodontist forces his maxillary teeth to occlude with their cusps in some resemblance of proper relation with their mandibular antagonists. Then what? The treatment has been completed; the fee earned. Retention follows. Retention—what a word in this condition! There can be no hope from retention. If anything like a decent result is attainable at all, it is lost if retention is applied, because retention indicates a static condition, and no static retainer will prevent the continued normal development of the mandible, and the continuous subnormal development of the maxillae. So called retention, therefore, must really be a continuance of treatment. Force must be continuously applied so as to retard the normal development of the mandible, if possible, and stimulate and accelerate the subnormal development of the middle third of the face. Well-made appliances which will retain the arch forms and admit of the continuous use of intermaxillary force will accomplish something. Perhaps, at the time of the seeming termination of active treatment, none of the third molars having as yet erupted, the extraction of the unerupted mandibular third molars might traumatically interfere with the development of the mandible, and thus do much toward preventing, or at least lessening, the so-called lapse, which is due to a progression toward that development which is inherent in those particular cells. These cases have not been cited as a suggestion in regard to treatment, but rather to afford concrete examples of lapses that are retrogressions, and lapses that are progressions. How, then, may such a study of lapses be achieved? How can a classification be formulated? I have been told that when Angle conceived the idea of formulating a classification, he visited many orthodontists, and studied their record models, finally discovering that they could all be practically allotted to places in three general classes. Now then, if a sufficient number of orthodontists could be induced to recall patients treated five or more years ago, and to take impressions and make casts of existing conditions as they are found after such a period of discontinuance of treatment, and if the before-treatment models, after treatment models, and models of lapsed conditions could be collected and studied, knowl-

edge would be acquired which would give us greater control over the results of treatment. Many men will hesitate to recall patients, for fear of what they may find.

W. W. Woodbury, Halifax, Canada: The title of this paper is "The Value of Orthodontic Experience in General Practice." Dr. Lockett states that he is dealing with the subject "Lapsing of Treated Cases" and this title would fit the paper he has prepared. In addition, he suggests that the general practitioner may aid in solving this problem. One cannot but agree with the statement that, in a large number of cases treated in the past, the teeth have more or less returned to the position that they occupied before treatment. That this constitutes a very real problem is patent to anyone who is practicing orthodontia and is conversant with the present situation in this field. Although the problem Dr. Lockett sets himself to solve is real enough and aid in its solution is sorely needed, the chief practical suggestion advanced is that the operator become a disbeliever; i. e., cultivate the critical habit of thought, and this is surely essential. He recognizes, however, that there are forces at work that are not within our control in the present state of our knowledge. It is the gradual recognition of this fact and the gradual persistent questioning of the older orthodontic canon that the achievement of a so-called normal (meaning "perfect") occlusal relation was the chief if not almost the sole factor in the success of a case that gives us hope for the future. As long as it was demanded that every mouth treated should approach occlusal perfection, it was natural for the operator to keep those cases that failed to achieve this out of sight. On such a strictly mechanical basis, anything short of perfection was simply a comment on his lack of technical skill. If, however, our conception of normal is an individual functional as well as morphologic one, and we recognize that tooth position and tooth relation are local expressions of the sum total of metabolic forces at work in the organism as a whole, we may find that, in terms of ideal occlusion, we shall have to cut our suit in many cases according to our cloth. The difficulty is to determine how much cloth we have in the individual case. In other words, diagnosis and prognosis with our newer knowledge and newer vision are not made easier; they are rather harder. The factors that we must try to evaluate are so complex. We must not be dismayed by this, but must try as persistently and patiently as possible to reduce this complexity to order. Not only the general practitioner of dentistry but also many men and many fields of science must be laid under tribute. And this is increasingly being done. But it will be many years, surely, before the orthodontic operator will be in a position to hand to many of his patients a guarantee or its equivalent. It would seem that the statement that the problem is quite different in Europe from what it is in America would need presentation of more definite data to lift it out of the region of opinion. Dr. Lockett should not forget that in America orthodontic service reaches only the merest fraction of the population of our cities. The small town and rural field are practically not touched. Economic factors will vary in different countries, no doubt, and in different parts of the same country, but perhaps biologically there may not be so very much difference in principle. Dr. Lockett is to be commended for the courage of his presentation. It is only by the frankest and fullest discussion of our problems that progress can be maintained.

PORCELAIN—ITS PROPERTIES*

By WILLIAM A. CAPON, D.D.S., Philadelphia, Pennsylvania

IN 1728, Fauchard, the father of modern dentistry, described the use of baked enamel in color or shade corresponding to natural teeth. Later, this method was extended to include gum-color enamel and gum section teeth, which were constructed by Fauchard, Bourdet and other dentists of France prior to 1760.

In 1774, M. Guerard, a porcelain manufacturer, made a denture of porcelain teeth for a French apothecary, which proved a success. In 1788, Dubois de Chemant, a Paris dentist, improved the process and obtained letters patent to manufacture porcelain teeth. These teeth apparently were of one color. Dubois Foucou made an experimental study of the color problem in porcelain, publishing his results in 1808. In the same year, Fonzi, an Italian dentist, invented the platinum pins.

A. A. Plantou, a French dentist, migrated to America in 1817 and introduced porcelain teeth. After him came Peale, in 1822; Stockton, in 1825, and Samuel S. White, in 1844. From that date until the present, teeth forms have been improved, and many names of clever dentists could be added to this list.

I present these few facts related to the introduction of porcelain into dentistry simply as a brief historical introduction to my subject.

All ceramics, from a Sevres vase to a drainpipe, are composed of essentially the same elements, the difference being entirely in the proportion of the different ingredients. Porcelain, which is the highest product of the ceramic art, is a hard, vitreous, translucent substance produced by the fusing of several minerals in connection with clay.

The materials used are kaolin, silica and felspar, and often potash, soda or lime is added to increase the alkaline flux of the feldspar.

Glass is also a compound of silica with potash, but differs from porcelain in that all its component parts, broadly speaking, are fusible, making a chemical solid solution; while porcelain contains infusible elements held together by the lower fusing enamel. This is a mechanical mixture.

The quality of porcelain produced depends on the skill in choosing materials and proportions so as to produce the results required. The element of time required for heating and cooling must be also taken into account. The variation in density that porcelain undergoes in fusing is not thoroughly understood. It appears to be very irregular, and, in some cases, porcelain loses weight much faster than it does

*The papers of Drs. Capon, Thompson, Vehe and LeGro make up symposium on "Porcelain."

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bulk, so that often the density of the material is decreased by firing.

The purest porcelains are made from three mineral substances, quartz, kaolin and feldspar.

Quartz is ground to an impalable powder, and as its fusing point is much higher than the temperature used in baking porcelain, it remains unchanged and serves as the framework of the porcelain.

Kaolin gives the properties of toughness and opaqueness. When subjected to high heat, it adheres to the framework, quartz, and, parting with its water of hydration, shrinks badly. If we mix these two materials together and bake them at the ordinary temperature of baking porcelain, we will have an exceedingly porous mass resembling an unglazed brick.

Feldspar is a true chemical compound composed of silicic acid and the two bases, alumina and potassa. This is, strictly speaking, a natural high-fusing glass. The feldspar fuses and forms a flux to unite solidly the particles of quartz and kaolin and fill all the spaces between the molecules of the mixture. The less flux used, the higher the fusing-point, and the less perfectly are the pores filled; consequently, the higher the fusing-point of the porcelain, the more porous, and, conversely, the lower the fusing-point, the less porous.

Another cause of porosity is overheating of the porcelain so that its constituents are decomposed, producing certain gases that are caught by the viscid flux, thereby injuring the porcelain. The inherent cause of porosity in the low-fusing porcelain is the large amount of potash or its equivalent, and therefore that which is soluble in the fluids of the mouth. This explains why a medium to high-fusing porcelain is the best for crown and inlay work.

Filling cavities in natural teeth with inlays to resemble the tooth structure is recorded as early as 1820, when Dr. Linderer used animals' teeth ground to the form of the cavity. They were held in position by the swelling of the material under moisture, but they soon became discolored. In 1837, Dr. Murphy, of London, reported using glass in labial cavities. In 1862, Dr. B. W. Wood presented an article entitled "Enameling Plugs and Restoring the Contour of Defective Teeth by the Application of Enameled Caps." His method is not clearly revealed, but he is the first man recorded as suggesting the enameling of a metallic cap for badly broken down teeth. This is practically the basis of our porcelain jacket of today.

Dr. Starr, in 1870, reports having had porcelain pieces in which pins were fused for retention, and Dr. Weagant had instruments constructed that cut the cavity to correspond to the piece of porcelain used.

C. H. Land's patent, executed in 1887, covered the method of burnishing ribbon platinum into the cavity, making a matrix of the same form as the cavity and fusing porcelain in it with the aid of a gas furnace. It undoubtedly was distinctly different from any other method recorded up to that time, and it is this method, with modifications, that is largely used in practice today in making porcelain inlays.

It can well be understood by this brief and incomplete record that the desire of many early operators was to discover some method that would enable them to substitute unsightly dental restorations with a material that would

harmonize with the natural appearance of the teeth and yet be durable. Porcelain was generally accepted as being the material, but its application and its manipulation in small and irregular forms was not possible until Dr. Land's matrix system and his gas furnaces solved the problem of fusing porcelain quickly, thereby adding greatly to the improved and beautiful dentistry of the present time.

The use of porcelain has many advantages inasmuch as it conserves tooth structure and offers great resistance to the wear of mastication and the action of the oral fluids. It almost harmonizes with the natural tooth shade and excludes bacterial growth at the cavity margins; it has the quality of nonconductivity of heat and electricity; its manipulation is not hard on the patient nor for the operator with experience; and reinsertion and duplication are easily accomplished when desired.

STRENGTH

The average crushing strength of a manufactured porcelain tooth is 1,000 pounds to the square inch, and the average of an inlay porcelain is only a few pounds less; to be exact, 940 pounds. A porcelain tooth will have greater resistance to force at all times, because of its larger bulk and, being pressed into form under heat and force, the porcelain is more nearly uniform in character.

Inlays made from porcelain are of such varied sizes and irregular shapes that resistance to force is reduced, because the bulk of material is much less than a porcelain tooth.

One of my first instructions in teaching inlay construction is that depth of cavity means resistance and retention, but that the strength of this material consists largely in the quality of porcelain used and depends on its being properly fused by experts. Porcelain inlays are more frequently made, and by those who are not expert in fusing it; therefore, the strength of resistance is below that required to withstand mastication and leverage. I have enumerated some of the advantages of the use of porcelain from an operative standpoint, but there are disadvantages also, and the recognition of these may save many ambitious dentists much time and embarrassment.

There is no phase of dental practice that requires more rigid attention and exact knowledge of the vagaries of the material than that pertaining to the practice of porcelain restorations of any size or form, from the smallest inlay to full continuous gum denture. A special equipment is necessary mentally and mechanically. He who does this character of work must be endowed with a particular artistic sense and the ability to apply the combination mechanically to the satisfaction of himself and his patient, with the property of durability in mind under all conditions. Added to this combination is the physical side that must be considered with all dental operations; but with this phase of practice, it is increased almost to the exasperation point. Delicacy of touch must accompany the artistic sense or all efforts are wasted.

FUSING

The greatest difficulty encountered lies in acquiring a working familiarity with porcelain changes during fusion, and this can be attained only by continuous practice. Perhaps the most uncertain quality of porcelain is that of shrinkage, and as this is practically an unknown quality, it presents a discourag-

ing barrier. Shrinkage and fusion are concurrent with the necessity that the latter must occur to gain the former, and, by the various stages of fusion, we must carry the mass to a complete shrinkage, but not to a finished product.

This brings us to probably the most important point wherein the whole operation may fail or be successful. We must have quality for strength and correct shading for appearance, and overfusion destroys both. By overfusion, the component parts are destroyed, or partially so, porosity of the bulk resulting in proportion to the overheating. This, of course, destroys the coloring matter in the same ratio. Overheating may destroy the surface and shade without detriment to the interior portion, which, of course, is explained by the fact that a higher fusing material has been used for the base or that part which represents the dentin of the natural tooth.

Overfusing porcelain is the most usual error because of the desire to have a high gloss; whereas, a slight deficiency of gloss is more natural and insures strength and shade. Porcelains may be designated as high, medium or low fusing, but in the manipulative stages they are alike, and, when properly fused, will all appear the same, defying the most expert to distinguish one from the other.

As I have mentioned a few of the difficulties to be encountered in obtaining proper fusing, it may be in order to say a few words with regard to overcoming these difficulties as a guide to the uninitiated or unsuccessful.

As a teacher for many years, it has been my privilege to start many young aspirants toward a successful practice of this kind of work. Many are deterred from entering this field because of the initial expense of the outfit. Postponement until a practice is established means a loss of enthusiasm and unfortunate delay in laying the foundation for a class of dentistry that means advancement. You all know that dental apparatus of all kinds has increased in cost in the same ratio with other equipment, and nothing so much as that in which platinum is a requisite; therefore, our necessary outfit includes a furnace, with, if possible, a pyrometer attached. This entails the outlay of $300 or more by a perhaps already overburdened beginner. To those, I will say that this expensive outfit can be reduced considerably, first by buying a second-hand furnace, and there are many of them on the shelves where they were placed a few years ago. They may require new muffles, but those and the other necessary parts usually can be bought at comparatively low cost. Secondly, the pyrometer may be dispensed with if one learns to fuse without it. True, it is a splendid guide for heat; but it is only a machine and it has no brains. The best and truest porcelain is made by the manufacturer, and he does not use a pyrometer. He knows heat lights and watches his fusing, and that knowledge is absolutely necessary to all porcelain workers and more applicable to those of us who are using and must use judgment and apply it, for our various sizes of forms require more or less heat as the case may be.

This familiarity can be obtained only by constant practice and by noting the condition of the porcelain surface as the rheostat is advanced. In the course of time, the operator will gain confidence and will eventually recognize the various stages of fusion called biscuit bakes.

A high biscuit bake means heating porcelain sufficiently to obtain shrinkage, but not enough to produce a glaze; therefore, the next step of the operation is the real porcelain with gloss.

The hardest and purest porcelain is assured by a longer period of heat on a lower point of the rheostat. Many years of constant and continuous practice has made me familiar with all phases of this class of dental work, and I am prepared to make the statement that any one desiring to follow this work is well on the way to success if he will master the fusing of porcelain. When this is done, the way is open to opportunities and advantages that will enable any dentist to overcome obstacles hitherto unsurmountable. It is fascinating and remunerative work, accompanied by appreciation on the part of the patient; therefore, surmounting its various difficulties is a pleasure and satisfaction.

Having had so many years of continuous intimacy with this phase of dentistry I find it difficult to discontinue the subject and conclude the portion of this report alloted to my consideration, I do so by relating an incident illustrative of the value and importance of baking porcelain independently of any mechanical agency of guidance.

About twenty years ago, when porcelain was a fad, an enterprising dental firm endeavored to introduce a pyrometer by sending a portion of porcelain powder to various dentists who were supposed to know and practice this branch of work. Each received the same quantity and quality and was asked to fuse it and return it to the sender. I returned my allotment, fused, and with it the number of the porcelain and name of the manufacturer. It was many months before I saw the dental dealer and asked him the results of his fusing test. I was informed that few were correct; in fact, he expressed surprise that so many calling themselves porcelain workers could obtain such results. The porcelain was a low fusing variety and very dark in shade; therefore, it was difficult to avoid overfusing it and losing the shade.

PORCELAIN INDICATED AS A FILLING MATERIAL*

By J. M. THOMPSON, D.D.S., Detroit, Michigan

DURING the winter 1890-1891, Dr. Capon made the first porcelain inlays ever made in the Philadelphia Dental College. The patient, Dr. Stackhouse of Buffalo, wore those inlays over thirty-two years (to my own knowledge). From an artistic standpoint, they were not at all desirable, but they functioned nevertheless.

Owing to the unsightly appearance of the materials available at that time, inlays did not become popular. Ten years later, Dr. Brewster of Chicago brought out a medium fusing material, which was ably demonstrated by Dr.

*Read before the Section on Operative Dentistry at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 25, 1926.

W. T. Reeves, and its use spread like wildfire. About the same time, Dr. Jenkins, of Dresden, Germany, demonstrated his low fusing material, and then the well-remembered controversies over the qualities of each occupied much time at dental meetings all over the country.

The advent of the Custer, Price, Hammond and other small electric furnaces gave added impetus to the making of inlays, which were, in the hands of many, successfully and beautifully done. Like many other things, inlays suffered at the hands of the over-enthusiastic advocates, who claimed that porcelain should be used everywhere in the place of gold.

Before the profession had mastered the technic of making good inlays, we were thrown into a mortar bed of worthless synthetic materials which, while they at present are greatly improved, have a long way to travel toward perfection or a fool-proof stability.

There never has been a time when a louder outcry should be made against the wholesale use of synthetic cements. The constantly recurring failures presenting themselves, not only from our own efforts but in the mouths of patients coming from all parts of the country, create this belief.

It is not the purpose of this paper to belittle the efforts of the various manufacturers who are striving to produce a faultless material, but until the silicates give more nearly uniform results, it is up to us, as users, to watch our step.

The line between a perfect mixture and a poor one is so limited that only those who use rare judgment attain an approach to permanent results. Either there is a glaring ignorance in the use of these materials or there is a manifestation of gross carelessness in the mixing and insertion. It would almost seem that esthetics had taken the place of ethics. Dr. Henry Boenning once told our class in anatomy that women especially would go through anything for the sake of esthetics, and while I do not like to see a display of gold in any tooth, there is much to be said in favor of its staying qualities.

Many times when we see the gold fillings from our own hands that have seen thirty or more years of service and are still doing what they were intended to do, and then see the continual need for repair necessary (and increasingly so) where synthetic materials have been carefully used, it makes us long for the return of the plugger and the mallet. The scope of this paper does not permit me to say just how to meet this problem. The paper to follow deals with this part of the subject.

The advent of the gold inlay seemed to relegate every other kind of filling to the discard, and its acknowledged strength and beauty need little comment at this time. Gold inlays, however, have brought about a condition that is the source of much mischief. Many overfilled molars and biscuspids have lost vital pulps and become direct causes of trouble. Dr. Rickert of Ann Arbor speaks of this condition as "the demon in the dark."

It sometimes seems possible that the old slogan—"Save the teeth" has been replaced by a commercial spirit, and pounds of gold is being put into teeth regardless of the condition of the pulp. Neuralgias that are hard to diagnose and subsequent foci of infection and their train of evils follow.

I was asked to state where porcelain

inlays are indicated. They are plainly indicated in all buccal cavities, especially in lower molars and bicuspids. It is heart breaking to see large gold inlays in these cavities in molars that already have been filled to the limit with mesioclusodistal gold inlays. In most of these cases, thermal changes do their deadly work, and sooner or later the tooth is lost.

John J. Travis, of Ann Arbor, has already sounded the alarm, and in his late papers is crying out against the ruthless cutting of the first molars of the young and the insertion of large gold inlays. It was to this that he attributed much of the trouble found in the mouths of patients under 20 years of age. Large restorations of synthetic cements are as dangerous as large gold inlays, and it would then seem that porcelain should be used in preference to all other material.

The old argument that porcelain is the nearest to the natural filling and that it protects the pulp from thermal changes holds just as good today as it ever did, and a well-fitted inlay set in a good quality of cement is better than all the synthetic materials made up to date.

The use of inlays in incisors either upper or lower should be governed by the condition of the teeth in which they are placed. Large approximal cavities in these teeth in which sufficient room can be procured may be beautifully and safely restored with an inlay. This also applies to bicuspids in either jaw, and where there is room enough for the material, mesioclusodistal restorations can be safely made.

PORCELAIN TECHNIC AS IT RELATES TO THE INLAY*

By W. D. VEHE, D.D.S., Minneapolis, Minnesota

THE failure to use porcelain in dentistry generally is largely due to the prevailing belief that it is more difficult to manipulate than other filling materials and that it requires a special aptitude on the part of the operator. This belief seems to be so thoroughly ingrained into the very fiber of the profession that the younger men dare not make an attempt for fear of failure and discouragement. An analysis of this hypothesis does not bear out this contention; for when a comparison is made of porcelain technic with that of other filling materials, it must become evident that the basis for a mastery of it is the same.

To one familiar, for instance, with the cast gold inlay and not with porcelain, the desire to appreciate and understand fully the requirements that porcelain makes which gold does not impose suggests itself. With this thought in mind, it must be admitted that the physical requirements of these materials are not the same, while the manipulative requirements are the same in degree even though not in kind. Technic, in this instance, is merely the procedure in-

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volved to manipulate these materials to meet certain requirements and to produce definite results in the mouth; and, as it is to be perfected in the working of gold, it could be done as easily. The difficulty even today is that so many are

Fig. 1.—Cavity on labial surface.

Fig. 3.—Cavity on buccal surface.

viewed from this angle, it must be observed that either procedure is largely and primarily a mastery of details.

It is not to be denied that porcelain imposes exacting requirements on the operator, but one must admit the same

not thoroughly proficient in the manipulation of gold, and can these same men be expected to do any better with porcelain? It seems impossible to anticipate this in view of the fact that the requirement for porcelain is more

Fig. 2.—Cavity on labial surface.

Fig. 4.—Cavity on proximal surface.

of gold. There is a natural preference for gold as compared with porcelain. Were it as necessary to master porcelain

limited. Naturally, practice leads to perfection, and if the operator is not forced to make an accurate procedure

more or less automatic by a repetition of it, he will not succeed unless he has the desire and the persistence to work out a technical perfection.

also as regards the natural requirements of the materials of which the inlay is to be made. Cavity preparation for the porcelain inlay does not differ much

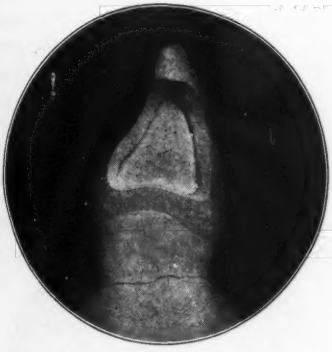

Fig. 5.—Cavity on proximal surface.

Fig. 7.—Cavity on proximo-incisal surface.

Obviously, the object of the inlay is a restorative one, and in replacing lost tooth structure, porcelain meets the added requirement of esthetics. In designing such a replacement of tooth

from that for a metal inlay, except in a few details, and these differences are made necessary by the physicial requirements of porcelain.

In the one surface cavities, whether

Fig. 6.—Cavity on proximal surface.

Fig. 8.—Cavity on proximo-incisal surface, labial view.

structure, several factors naturally are involved, not alone as they pertain to that portion of the tooth remaining, but

on the labial or the buccal surfaces (Figs. 1—3) or on proximal surfaces

of the anterior teeth (Figs. 4—6), the preparation of the cavity simulates closely that for the metal inlay. Good depth is necessary for good color and anchorage, and all walls should be cut to meet the surface of the tooth at a right angle. This precaution should be observed in all preparations for porcelain, so that the porcelain as well as the enamel margins will receive all possible protection. Where the cavity extends into the dentin, these walls may be made parallel, and the base of the cavity should simulate the original contour of the tooth. The cavity outline is governed by the amount of tooth structure that is involved, of course, but the operator should adhere to graceful curves rather than sharp angles, not only for esthetic reasons but also because of the greater ease in adapting the matrix. All walls should be planed smoothly, and the margins should be sharply defined.

In proximal cavities, accessibility for making the matrix and for setting the work must be a vital consideration. When separation of the teeth will not provide for this, the preparation must be made with this in mind as well. When the incisal or occlusal surfaces are involved (Figs. 7—11), the condition at once becomes more serious and complicated. Here, the amount of the tooth involved, and the severity and extent of the occluding stresses, very largely govern the preparation. Good depth with sufficient bulk to withstand these stresses is, of course, important, and the margins should not be placed directly where the occluding teeth will strike them.

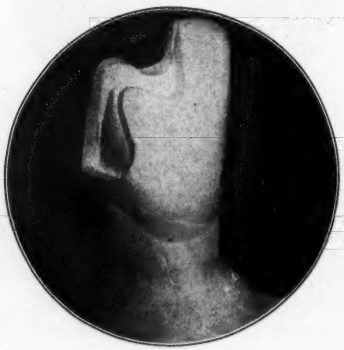

Fig. 9.—Cavity on proximo-incisal surface, lingual view.

Fig. 10.—Cavity on proximo-incisal surface, lingual view.

Matrix making naturally follows the cavity preparation, and for this purpose, platinum, gold and platinous gold foil, in various thicknesses but usually of one one-thousandth of an inch, are used, depending on the fusing point of the porcelain and also on the desire of the operator. This matrix may be made in one of three general ways: (1) directly, forming the matrix in the tooth cavity; (2) indirectly, forming the matrix either on the impression of the cavity

or on a die of this cavity; (3) indirect-directly, forming the matrix at least quite accurately on a die of the cavity and then reburnishing it in the tooth cavity.

The matrix may be made in any of these ways, depending on the location of the cavity and the wishes of the operator. The object always is to make it entirely accurate and to keep it so until the work is completed, and how this is done does not matter as long as

Fig. 11.—Cavity on proximoclusal surface.

the operator does it in the easiest way for himself and his patient and in the shortest time.

Possibly, the most matrices are made by the direct method, and where there is good access to a cavity on a surface of a tooth that will permit the matrix to be held firmly during the burnishing process, it is the quickest and, at the same time, the most accurate method. At least, there is no way of doing it any more accurately than this. In burnishing a matrix directly, it is desirable to have the foil well annealed and of the proper size. It should be large enough to project beyond the orifice of the cavity for several millimeters at least. This is necessary so that the matrix will not become distorted easily in the fusing process and to facilitate the proper contouring of the work in building. To shape the matrix, the material should be placed over the cavity, and with the aid of small pellets of cotton, spunk or some such material under a suitable burnisher, it should be worked into the deeper parts of the cavity by stretching the metal before it is forced over the surfaces of the tooth. The metal should be stretched as carefully and as

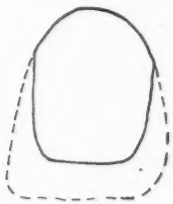

Fig. 12.—Extent of cervical color worked out.

much as possible, and care should be taken not to allow folds to come into it. Lastly, the foil should be forced over the surface of the tooth only after the cavity portion has been worked in and then the more accurate burnishing should be completed. For this latter burnishing, the matrix should be held rigidly with the aid of suitable material such as China silk cut into strips, or some sort of tape of silk or cotton, or even rubber dam. Perhaps of these materials common silk seam binding that may be obtained at the notion counter of any dry goods store is as suitable as anything. At this point, it is generally well to anneal the foil in the flame of

a blowpipe, after which the final burnishing is done. A last inspection should show an entirely accurate reproduction of the cavity in every detail. There should be no folds nor tears at the cavity margins and it should have a smoothness corresponding to that of the cavity and tooth surface. Sticky wax that will burn off cleanly may be used to facilitate the removal of the matrix without distortion.

A matrix may be made indirectly either over an impression of a cavity or on a die of the cavity. There is a distinct advantage in making it over an impression of a cavity in the class of cavities with four walls, such as the labial, buccal and some proximal cavities; for, in doing so, the inside of the matrix corresponds to the cavity size and outline rather than to the outside of it, and the thickness of the foil has nothing to do with the fit of the completed inlay. The technic for this procedure is minutely exacting but not difficult. The impression of the cavity may be obtained in a good cement, and the matrix is then made thereon. The best procedure consists in making the impression in casting wax and casting this impression in gold. This casting is then mounted in a swaging base with the cavity portion uppermost, after which the matrix is made in the usual way. The difficulties that may be encountered in this process are tears at the margins just where they must not be. This can be avoided by carefully tucking the foil into the deeper portions even with the folds before swaging it down to place. In this matrix, folds do not matter, and the requirement is that the inside of the matrix correspond in smoothness with that of the cavity.

The technic for making a matrix indirectly is well known and need not be considered here. It corresponds to the direct method except that because the matrix is made out of the mouth, it is more easily and quickly done. The indirect-direct method is indicated in the more difficult cases in which the operator wishes to form the matrix more or less accurately on a die made of cement, usually, and then reburnish it in the tooth cavity.

The color problem should be carefully taken up at the completion of the matrix, or the impression of the cavity if the matrix is to be made indirectly. No matter how accurate the inlay may be when completed, if the color is wrong or if it violates the esthetic feature in this respect, it must be con-

Fig. 13.—Outline of incisal color.

Fig. 14.—Completed color diagram.

sidered a failure. Because color means so much in the inlay, it is necessary that it receive careful consideration. The principle of color interpretation in porcelain is the same in the inlay that it is in the veneer crown except that we are dealing with but a part of a tooth crown and we have reflection and refraction of light to deal with to a greater extent. However elusive this problem may appear to be to the beginner, it should never be mysterious, for the color problem can be worked out to be as scientific and as accurate as any part of the procedure. The first requisite is a color guide that accurately represents the colors of the porcelain with which we are working. This means that the manufacturer's color guide may not be right. With this, then, as a beginning, we must learn to see the colors in the tooth as they really are and then match them with the colors on the color guide. It is best to diagram the color requirements of each case on a suitable card. This diagram may consist of a sketch of the labial or buccal outline of the tooth to be treated, with the extent of the involvement and the color requirements accurately worked out. (Figs. 12—15.) Such a record has many advantages and may include, aside from this color diagram, measurements to assist in building the work, staining information and any other data that may be of help.

When a preparation is properly made, and an accurate matrix obtained, and the color requirements are exactingly worked out and recorded, the building of the inlay should not be difficult. Naturally, great care must be exercised constantly not to distort the matrix during the process of building the work. Provision must also be made to prevent distortion during the fusing of the porcelain. The latter effect can be prevented by investing the matrix, or as is usually done, by painting a thin solution of shellac in alcohol on the walls farthest from the center of the matrix or at the points where the most severe contraction will take place. Other methods are used to obviate this possibility, such as cutting the porcelain after it is built with a sharp lance in the form of the letter X or building the porcelain to full contour without covering the walls of the matrix. It seems that the shellac method is the accepted one because it allows full contouring at each building and it likewise is the more positive. The shellac is only applied before the first contouring.

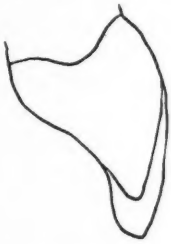

Fig. 15.—Cross-section of color scheme.

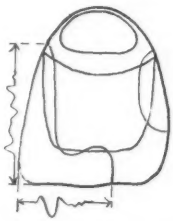

Fig. 16.—Color requirements for the inlay.

In working the porcelain, care should be taken to work out all air and to keep it clean. Angles and grooves must be emphasized and an amount may be allowed for contraction in fusing, but aside from this, the work should not be overcontoured, nor should porcelain be built over the margin of the foil. The cervical and incisal colors should be properly placed for correct color effects at each contouring. Usually, three fusings are sufficient to complete an inlay and overbiscuiting or overfusing generally are fatal to a good result. Just before the last contouring, the inlay may be tried in the mouth to verify contour, contact and occlusion in the more difficult cases, and it is also best to dress down the margin of the foil while it is in the tooth or in the metal die with suitable small true running stones. This dressing down is not done quite so far when making the matrix on an impression.

After this final fusing, the foil is removed and the cavity surface of the inlay should be roughened to obtain greater adhesion of the cement. This may be done with a suitable stone or diamond disc, or with hydrofluoric acid. The work should be carefully set; otherwise, a perfect restoration may be ruined in a moment by fracturing a margin. The selection of a proper cementing medium may be somewhat of a problem, since the silicates have come to supplant, at least partly, the use of the oxyphosphate cements for this purpose. As the silicates have not ample time to demonstrate their complete reliability for the cementation of this work, if one is permitted to judge their usefulness generally, one cannot rest with complete assurance in their use. It is hoped that the newer cementing mediums will live up to our expectations of them, as the color advantage in the porcelain after placement is so much superior to what we have had to contend with that the operator has every opportunity to become enthusiastic.

In cementing with whatever medium, the work should be held in place firmly until the cement has become set quite well or until there is little danger of the inlay being moved. It is not desirable to remove all of the cement at this time, but at a future sitting, the margin should be finally completed by running over them with a suitable small Arkansas stone under water, and the occlusion should be checked again.

This, then, completes the operation, and whether it is a simple one surface restoration or one that is more complicated, it must be plainly evident that the procedure is largely made up of carefully worked out details. Perhaps many of us in attempting such an operation have the whole mass of detail in mind, with more or less confusion to ourselves when we should be confined to but one and allow the next one to come in naturally. It is but logical to reason that each step should be carefully completed in the procedure before the succeeding one is attempted, for a good result, and when one follows through an operation in this manner, there can be but one result; namely, a restoration that is the highest expression of the restorative art, and if it has been properly selected, it will be a source of satisfaction to the operator and of gratification to the patient.

823 Nicollet Ave.

PORCELAIN—INDICATIONS AND CONTRAINDICATIONS*

By ALBERT LELAND LEGRO, D.D.S., F.A.C.D., Detroit, Michigan

A PERUSAL of dental literature over a period of two decades discloses many cycles through which the profession has labored to arrive at the present partial conclusion as to the status of porcelain: partial conclusion, because the dental profession seems to ordain that there must ever be two sides of merit to every question. This is not stated as an indictment; for it is realized that two are better than one to keep any practice on a safe and sane middle ground. It is gratifying, however, to observe that the recognized indications for the use of porcelain for restoring lost tooth substance are fully as frequent as for any other material now employed by the dentist. The ability to manipulate the material is in a proportionately larger number of hands than a decade ago, and as a result, we constantly see porcelain employed in an ever-increasing number of cases.

It has not reached such a stage of development that the realm of the entire mouth is conceded to porcelain. Judgment born of great care and ability must ever be the watchword in the employment of any one material; but the time has long gone by when the intelligent and discriminating patient will tolerate the lavish display of metals in the mouth. It is not necessary; therefore, inexcusable. To those dentists who insist that the artistic go hand in hand with all practical mechanical dental accomplishments and who attract a clientele that appreciates and demands that every honest effort be made to simulate as nearly as possible the natural composition, anatomy and hue of lost tooth substance, together with a degree of permanence in the work, the present high state of the art is credited.

Rarely, if ever, is one confronted with recurrence of decay around fired porcelain restorations; which, together with the rare quality of nonadherence of food, is perhaps among the most important reasons for using porcelain where indicated. If color, nonconductivity and its many other assets were not considered, the other two should give the material a position equal, at least, to that of any other now made use of by the dental practitioner.

Porcelain today is clearly indicated in certain types of cavities in the form of inlays; in jacket-crown work and in fixed bridgework in the form of porcelain individual saddle and tipped pontics. In discussing the indications for porcelain inlays in various locations, it is well to take into consideration the general dimensions of the individual teeth and the surface contours as they relate to their dimensions; e.g., an extremely thin central or lateral incisor with cavity or cavities involving the incisal angle offers in dimension and

*Read before the Section on Operative Dentistry at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 25, 1926.

surface contour nothing that would justify the insertion of a porcelain inlay. The lower incisors offer hazardous cases, and, in fact, certain types of every tooth in the natural denture preclude the indication for porcelain inlays. There are many mouths, too, that will not permit of the insertion of the most perfectly adapted borders in porcelain for esthetics, owing to such untoward conditions as uncleanliness, precipitated pigments and smokers' stains. It is therefore clear that, with porcelain, as with any other material now employed, great care and judgment must be exercised and that the indications must far overshadow the contraindications.

Porcelain inlays are perhaps the best restorations that dentistry offers today for all cervical cavities, lingual, labial and buccal, not involving any other surface. When such cavities involve the tooth structure adjacent to or under the free margin of the gum, the glazed porcelain, with the possibility of accentuated anatomic gingival restoration so necessary to the retention of normal conditions of this tissue, makes a most clean and welcome substitue for the lost tooth structure.

Only in rare instances should porcelain be employed in proximal or occlusal cavities in the bicuspid and molars. As it is advisable to prepare all cavities for porcelain with walls at right angle to the enamel surface or nearly so, it is recognized that the general anatomy of these teeth does not lend itself to this preparation. Only where there is great loss of tooth substance are porcelain inlays indicated in these teeth, and it would therefore seem wise to classify such restorations as exceptional. In cervical cavities, this material may be employed on the buccal and lingual surfaces extending from the deep cervical region almost to buccoclusal and linguoclusal unions. If the cervical cavities extend to any part of the approximomesial or distal surfaces, especially in such cases as present continued lines of decalcified area involving two or three surfaces in an extended ribbon-like form, porcelain inlays are contraindicated. In the molars, most cavities of usual outline, such as occlusal or mesioclusal, porcelain is not indicated for two reasons; namely, first and most important, the contour of these teeth will not permit of proper preparation, and, second, there would not be sufficient bulk of porcelain to insure strength. The indication is reversed when such teeth contain cavities progressed to the extent that it becomes necessary to remove a buccal or lingual wall in part or whole, or the progress of caries has caused the recession of the pulp and the dentin has disappeared to such dimensions that a jacket crown preparation could not be considered. Such cavities necessitate great bulk of porcelain, and the material here is clearly indicated.

For bicuspids, only cervical cavities are indicated, though one occasionally sees a mouth with many successful approximoclusal porcelain fillings in these teeth. The failures of porcelain, however, in all cavities in bicuspids, except in the cervical, are high in percentage.

In the cuspids, especially the superior cuspids, the approximal inlay not involving the cuspid angle is of great value and shares with certain approximal

cavities in lateral incisors and especially central incisors the designation of the most important locations for the porcelain approximal inlay.

For approximal cavities that do not involve the incisal angle in incisors and are large enough to admit of good impression or matrix technic, the porcelain inlay comes nearer than any other restoration to solving the problem from every standpoint. They satisfy the most scrupulous demand in esthetics; are durable and capable of long use; do not, as usual, permit of decay, and, when well executed, are appreciated for their cosmetic effect. Unlike the incisal angle porcelain inlay, the borders do not stain so readily and, when equally well done, are more desirable than restorations made of any other material. When the manufacturer succeeds in producing a translucent cement equal in adhesiveness and as resistant as finely ground oxyphosphate cements, the use of fired porcelain as a dental restorative material in all anterior teeth will be indicated for all cases presented, except in the extremely small approximal cavities.

Fixed-bridge workers have long recognized the desirability of using glazed porcelain wherever it is necessary to touch the delicate epithelial surfaces, and gradually a simple technic has developed that makes it possible to employ this material in a large number of cases. The porcelain facings are tipped with porcelain in such a manner that, when not allowed to infringe on the gums, this type of bridge is perhaps the most cleanly of all fixed appliances in the mouth. The technic for producing the individual saddles and tips for pontics is perhaps the most simple of all dental ceramic procedures.

In the employment of the jacket crown in restoring any individual tooth, porcelain reaches its greatest height and perhaps surpasses any restorative feature now employed in dentistry. Time has convinced the most skeptical, and it is now recognized that restoring the entire enamel area on a properly prepared tooth is a procedure that retains the vitality and health of a tooth for an indefinite time.

In cavities of the incisors and cuspids involving both incisor angles and frequently only one angle in the average denture, the placing of a jacket crown is justified.

In lateral incisors and first bicuspids, the teeth that are devitalized so readily, jacket crowns are particularly indicated, especially when the pulp is in danger from the technic used in the filling preparation. Molars and bicuspids are ideal teeth for jackets when the bite is not too short and sufficient dentin remains around the pulp to insure strength and protection.

Wide shoulders in all cases are contraindicated. They are not necessary, and, when employed, often produce untoward conditions that are incompatible with the comfort and vitality of the pulp.

When porcelain jackets are employed for the posterior teeth, the patient should be called at least every six months, and a check-up should be made with articulating paper to note that the general wear of the adjoining teeth has not left the porcelain to assume all the burden of occlusion. It may be necessary to grind spots on the occlusal surfaces each time; in fact, in a properly occluded porcelain crown, it is wise to roughen the surfaces in actual contact with opposing teeth so that the porcelain

will automatically grind its own occlusion in harmony with the wear on the other teeth.

Porcelain jackets on molars and bicuspids, unless correctly shaped and properly occluded, are not the equal of the average gold crown, but when proper contour, environment, type and anatomy are included, together with correct surface dimensions, porcelain jacket crowns are the peers of any other type now employed.

Many teeth with large gold restorations eventually become devitalized, but under a porcelain jacket crown, this is rare indeed; which most surely favors the employment of porcelain in the form of jackets.

To recapitulate: Porcelain is indicated in the form of inlays in all cervical cavities and in approximal cavities of the six superior anterior teeth not involving the incisal angle. It is employed for glazed tips and individual saddles in fixed-bridge work and for jacket crowns on all teeth. It should be kept in mind that, as in all other materials, success depends on good judgment at all times, compatible with the diagnosis and mechanics of the case.

525 David Whitney Bldg.

THE TREATMENT OF ACUTE OSTEOMYELITIS OF THE JAWS*

By FREDERICK F. MOLT, D.D.S., Chicago, Illinois

AUTHORITIES differ as to the terminology that may be applied to that type of infection resulting in bone destruction of the mandible or maxilla which has been termed osteomyelitis. The contention has been made that osteomyelitis can occur only in the long bones. However, infections developing in the deep bony structures of the jaws are sufficiently analogous to those in the long bones that they may be considered as being identical.

The jaws, as shown on cross-section, exhibit the heavy outer layer of cortical or compact bone, that of the mandible being much thicker than that of the maxilla, and an inner cancellous or spongy bone. The spongy bone is made up of thin-walled cells containing myelitic material identical with that found in the marrow of the long bones. McCallum defines osteomyelitis as "a destructive process affecting the periosteum, the cortex and the marrow." As all these elements may be present in the jaws, the contention that osteomyelitis does occur in these structures would seem to be verified.

The occurrence of this type of septic invasion is practically always consequent to the "lighting up" of some latent infection. It may result from the death of a pulp and formation of an acute periapical abscess, from the acute exacerbation of a long standing chronic periapical lesion or from an acute flare-up in a deep pyorrhea pocket

*Read before the American Society of Oral Surgeons and Exodontists, Philadelphia, Pa., Aug. 20, 1926.

or a pericoronal area surrounding an impacted or incompletely erupted third molar. The frequency of acute manifestations following either extraction or failure to extract third molars lying with their crowns in the correct occlusal plane, but invariably with infected tissue pockets surrounding them, should be pointed out to the general practitioner (who is frequently so optimistic with regard to the eventual complete exposure of these teeth) and their extraction urged before such unfortunate results occur.

We may mention as well, with these bacterial factors, the possible traumatic disturbance caused by a blow or by excessive instrumentation; the combined mechanical and bacterial factors, as in the use of imperfectly sterilized root canal instruments or materials; the chemical factors as caused by the use in root canals of various tissue-destroying agents; the combined chemical and bacterial, as in the use of hydrogen peroxid in deep infected pockets or areas; or the combined traumatic and chemical, as the carrying of infection to the periosteum with nonsterile hypodermic needles or solutions.

For convenience, the four dental causative factors enumerated may be grouped as two: the acute initial abscesses and the acute flare-ups of the chronic lesions associated, and the pericoronal lesions grouped with the pyorrhea pockets.

The osteomyelitis may be primary or secondary. The invasion of the cancellous bone may occur before there are any symptoms of swelling; indeed, before there is even a well defined soreness of the tooth causing the disturbance. The bone involvement, on the contrary, may follow a diffuse swelling, with the occurrence of periostitis, osteitis and osteomyelitis in sequence. There may or may not be an accompanying necrosis. In some cases, sequestra are formed and exfoliated, while in others, there is a diffuse liquefaction and carious bone destruction with no sequestration.

In the type of case in which the invasion of the bone is primary, pain is extreme at the onset, and the cause and location of the cause may go unrecognized for some time. When a diagnosis is made, drainage should be provided to the cancellous bone area, either by the extraction of the offending tooth, or by incision and drilling or chiseling through the overlying compact bone, or both.

Cases in which the bone involvement is secondary run the course of acute abscess with edema, the pus localizing, if the infection is not aborted, intraperiosteally or subperiosteally, and lifting the periosteum from the bone.

It is manifest that the virulence of the infection is not necessarily so great a factor as the resistance of the host, in the cases of bacterial invasion, as in practically all of these cases, the infection has been latent or dormant for an indefinite period of time. With a lowered resistance, a low-grade infection may become virulent. The lowering of resistance may be sudden or gradual, owing either to shock, cold, systemic disease, chill or exposure; or to confinement, overwork, malnutrition or pregnancy.

The sequence of treatment, therefore, is to (1) eliminate the focus of infection; (2) reduce or confine the spread of the infection; (3) destroy if possible the invading organisms, and (4) build up the patient's resistance.

The elimination of the source of the invasion usually calls for the extraction of the offending tooth. This should be a question of judgment in the individual case, as an incision for drainage and later extraction may be indicated. The use, after extraction, of a dressing saturated with rivanol 1:500, or even the injection, hypodermically, of rivanol 1:1,000 into the infected tissues is advantageous, as the medicament apparently is definitely specific toward both streptococcus and staphylococcus. The use of such a dressing after the extraction of any third molar with an overlying tissue flap, or in the presence of any acute gingival or periapical involvement, has been a routine procedure in my practice for some time past, and the absence of postoperative infections because of its use has been a source of comfort. The rivanol dressing is renewed on alternate days until acute manifestations subside, after which the solution is used for irrigation.

Curettage is absolutely contraindicated in osteomyelitis, except that, after all acute disturbance has subsided, the exfoliation of sequestra may occasionally be aided by delicate and superficial curetting.

The confining of the infection to a localized area is accomplished in greatest measure by the continuous use of icecaps over the involved part. Dry heat or poultices—the almost invariable resort of the laity—are never to be used. This knowledge should be widely disseminated, and the physician, who is a frequent offender by his advice as to their use, should be informed as to the possible serious harm that may result. Cold decreases bacterial formation and reduces inflammation. Heat, on the contrary, while undoubtedly more comforting to the patient, increases the action of bacteria and disseminates the infection.

In those cases in which the use of the icebag and intraoral incision fail to arrest the spread of the infection, hot fomentations continuously applied to the lower cheek will permit of the localization of pus externally so that incision and extraoral drainage can be accomplished. Care should be taken to avoid the parotid region as much as possible.

The destruction of the micro-organisms, while in a great degree the business of the patient's own bactericidal efforts, may be aided by the use of vaccines, antitoxins or serums. The type of invading micro-organism must, of course, be recognized to make such therapy effective, and these methods should be resorted to after consultation and in collaboration with the medical adviser. The greatest value from antibody formation is obtained if this is resorted to in the early stages of the infection.

Aside from immunization, the building up of the patient's resistance can best be accomplished by rest, quiet, careful nursing and diet. It is a mistake to assume that there is no danger in such an infection. The frequent deaths from acute dental infections testify to this. Therefore, hospitalization may frequently be advisable, so that the various hospital, laboratory and operating room facilities may be available.

In the diet, all efforts should be to provide an excess of alkaline, since a so-called acidosis or lowered alkalinity is invariably present, and to give all the necessary vitamins, both C. and A. Whole raw milk in abundance should be taken for vitamin A, as well as cod-liver oil. Milk will provide for the

calcium deficiency to some degree as well. Citrus fruit juices, particularly orange juice, should also be abundantly provided, as well as tomatoes, either canned or raw, and other vegetables. The citrus fruits tend to alkalinize as well as to provide vitamins. Cod-liver oil may be given.

If acidosis is marked, sodium bicarbonate in 5 grain doses may be administered every three hours. Calcium lactate in 5 grain doses, three or four times a day, has an apparent value in replacing the calcium.

The use of ultraviolet radiation, both local and general, is of apparent value. The radiation treatments with the quartz applicator intraorally should begin with a 5 minute dosage, extraorally with 3 minutes, working up to 6 minutes. The general radiation necessarily is in the hands of the medical practitioner, and the dosage is to be determined by him. This may be amplified by such actual sun exposure as it is possible to obtain.

The subsidence of the acute symptoms marks the turning point of the infection. After this, it is necessary to wait for possible sequestration, with only irrigation as a treatment.

The possibility of general bacteremia or sepsis is the outcome most to be feared. The effort to localize the infection and to build up the physical resistance of the host will be the greatest safeguard against this contingency.

SUMMARY

1. Given a lowered resistance, any oral focus of infection may assume an acute aspect.

2. Deep pyorrhea pockets, infected operculi and chronic periapical lesions present the most potential menace.

3. Operative interference other than the establishing of drainage and the removal of the causative element is absolutely contraindicated.

4. Confining of infection to a localized area, and building up of physical resistance are equally essential.

5. Normal physical reaction should be depended on for the subsequent treatment, the comfort, rest and physical rebuilding of the patient having been cared for.

25 East Washington Street.

REGISTRATION OF MANDIBULAR MOVEMENTS WITH PLASTIC MATERIAL*

By W. A. GIFFEN, D.D.S., F.A.C.D., Detroit, Michigan

MANY able men have made valuable contributions to the study of the human masticatory apparatus, to aid in the construction of full and partial maxillary and mandibular dentures in order that they may be esthetic, comfortable and stable, and efficient in mastication.

In the attainment of results, the proximate normal should be our ideal. As emphasized in the work of George S. Monson, we approach the original anatomic relations as closely as the age and condition of the patient will allow, even though these relations are abnormal either from disease or improper function. While it is true that many patients can accommodate themselves to limited variations from the proximate normal, the fact remains that, on careful diagnosis, a small percentage of our cases at the plate-wearing age can be classed as proximate normal.

We are concerned in masticatory movements within the area of occlusion, or from extreme lateral or protrusive occlusal positions to central occlusion. The anatomic features which control these movements are best summarized in the following quotation from an analysis by J. W. Needles, given to the profession a year ago.

*Read before the Section on Full Denture Prosthesis at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 24, 1926.

ANATOMIC FEATURES WHICH CONTROL THE MOVEMENTS OF THE MANDIBLE

As long as all the teeth are present in good positions, the slopes and the articulating facets of the cusps, and the inclinations of the condyle paths are harmonious. The character and range of motion of the condyles are determined by the form of the articular surfaces and the ligamentary and muscular attachments.

The mandible is a solid body, and the base of the skull, with the glenoid fossae and the maxilla, constitutes another solid body. Any change of relation between the mandible and skull must take place as a change between two solids. Since this is true, any motion in one joint necessitates a related motion in the joint on the other side. Therefore, the right and left temporo-mandibular articulations must be considered as constituting two halves of a single joint. However, because of the peculiar nature of the movements in this joint, each side should be considered as composed of two joints, one a hinged joint between the mandible and the two articular cartilages, the other a sliding joint between the articular cartilages and glenoid fossae. The anatomic opening and closing of the mandible therefore cannot be regarded as a hinge movement, or solely as a sliding movement, but requires the proper coordination of the two elements.

The hinge motion of the condyles in the menisci is a pivotal motion about the intercondylar axis. The sliding motion consists of a forward movement of the condyles and the articular cartilages, considered as one element, upon the articular surfaces as the condyles advance, either singly or together. The hinge and sliding movements may be combined in any degree, or either may be executed independently.

The articular surfaces upon which the con-

dyles advance in the sliding movement, look downward, backward and outward. The size, form and direction of these surfaces vary in different patients and frequently on two sides in the same patient.

PRESSURE AT CONDYLES DURING MASTICATION

The fibro-cartilages which separate the head of the condyles from the articular surfaces vary in thickness in different individuals. The portions of the cartilage which lie immediately between the head of each condyle and the articular surface are thin, and rarely, if ever, can be sufficiently compressed to materially alter the relations between the mandible and maxilla.

We may conclude from the studies by Dr. George H. Wilson and Dr. Gysi that, in general, there is a compressing force applied at both condyles during mastication, the force at the balancing condyle being greater than at the working condyle. But when the center of force applied in the closure of the mandible is anterior to the center of resistance to that closing force, one or both condyles may be lifted from the articular surfaces. From these facts, and others which we have studied, we conclude that the slope of the articular surface is an important factor in directing the movements of the posterior part of the mandible.

To repeat, the construction of the highest type of dentures requires that the teeth be arranged in harmony with the movements to which they will be subjected in the mouth when anatomic relations are restored as closely to the proximate normal as the age and condition of the individual patient will allow.

In order to obtain what we are pleased to call balanced occlusion in artificial restorations, we must imitate or reproduce the movements in mastication. J. W. Green, one of the great contributors to the science of denture construction, maintained that we must use our final check in the individual patient's mouth as the final test. The great disadvantage is the difficulty in teaching this procedure. Undoubtedly, there are many men in this audience who can do this technically, but it is not a teachable process, as it is doubtful that any man has acquired this technic with less than ten years' experience.

Many devices have been designed that have various adjustments for registering masticatory movements. The great difficulty in the various complicated technics advocated by the designers is the danger in changing the adjustments without sacrificing some other detail. Finally, they are all based fundamentally in making registrations on plastic check-bite wax or an equivalent. All measurements can be made in plastic material.

Dr. Luce, several years ago, designed an articulator that would certainly register mandibular movements on a horizontal plane with modeling compound. Eichentopf also designed an articulator that would register mandibular movements in alloy or compound while in a plastic state.

Dr. Homer later designed an instrument called a relator. This instrument is based on the principles that any movement making a plastic path such as is made by teeth in plastic check-bites is best reproduced in plastic material.

The movements of the mandible are projected according to check-bite records of centric protrusive, lateral and intermediate occlusal positions in plastic material placed in cups on the instrument, representing the right and left fossae and incisor guide.

These projected guides will reproduce records from the individual patient of the incisor gothic arch and incisor paths, the sagittal and lateral inclinations of the condyle paths. Further, the teeth can be arranged in harmony with all these paths by following the technic laid down by Dr. Homer.

REDUCING PERIODONTAL IRRITATION TO A MINIMUM WHEN USING PARTIAL RESTORATIONS*

By W. F. CHAPPELLE, D.D.S., Buffalo, New York

THE possible causes of peridontal irritation are: (1) pulp irritation; (2) gingival irritation; (3) overloading the abutment teeth; (4) discordant occlusion, and (5) unopposed torques.

Before entering into a study of these specific problems, you are reminded that they are considered impossible of complete control; also since each case varies to such a marked degree, no thoroughly standardized method of procedure can be presented as a remedy. Many factors, such as temperament, intelligence, mental attitude, ability and willingness to cooperate, habits of mastication, arch alinement, occlusal types, tooth form, cost of work, and its permanency, and the skill of the operator; as well as the condition of the teeth, degree of immunity to decay influencing the desirability of cutting into the teeth for intercircumferential retention or the use of extracircumferential attachments, all have an important bearing on the work. What may be ideal may not always be practical, and vice versa. Therefore, the intelligent study of each case from all the foregoing angles, and the practical application of previous experience in planning each case should be urged for the best possible results in each case.

Certain principles should govern planning and construction. Some of the causes of peridontal irritation will be passed over quickly, as they will probably be covered by others in whose work they are a greater factor. Pulp irritation with regard to inlays and onlays is one of these. As it may be caused by clasps, it may come from three sources; (1) the rubbing of a loose clasp which does not have sufficient bearing surface for the work to be done, and wears through or partly through the enamel; (2) the bearing of a clasp on the gingival enamel or upon cementum; (3) the broadness of a clasp, which may cause chemicobacterial action if the clasp is not kept clean. More careful planning and making of clasps so that they will not move unduly; will have sufficiently accurate bearing, and no more than necessary; will be located as far from the gingival line as possible, or the surface under the clasps be protected by shallow inlays, are the remedies offered. Careful systematic prophylaxis by dentist and patient is the remedy for débris under and just below

*The papers of Drs. Chappelle, Bryan, Spalding, Burgess, Maves and Davis make up a symposium on "How May the Factors of Irritation to the Periodontium Be Eliminated in Dental Restorations?" A correlation of these reports will be found on page 1507.

*Read before the Section on Periodontia at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 25, 1926.

clasped surfaces, especially where no protection from inlays exists.

Gingival irritation as far as it may be caused by inlays or cast crowns, will be the fault of technic, covered by others on this program. It may also result from clasps settling onto the gingival border; also from spaces, usually less than 2 mm., between the saddle border and the gingival border. The remedies for both are obvious. The deflecting action of clasps, because they break the continuity of the buccal, lingual and approximal surfaces of the teeth clasped, deprives the gingival tissues of the massaging action of coarse foods, the tongue and cheeks, and favors also the deposit of lime salts and débris. Systematic prophylaxis by the dentist and patient is the only remedy. Careful design of clasps to eliminate bulk is assumed.

Both pulp irritation and gingival in time may become factors in peridontal irritation.

Overloading the abutments is the third factor. The indiscrete use of cast rests and rigid gripclaps on spans longer than two teeth, without some device for breaking the stress or some other means of relieving the possible stresses of mastication that may be applied to the supplied teeth, is dangerous. In my experience, the greatest use for stress-breakers is the breaking of the transmission of stresses of mastication to the abutments, and not the compensation for poor planning and making of clasps, which will, without them, produce unopposed torques or be impossible of placing and removing over irregular teeth without the excessive play between parts found in many stress-breakers. Adequate vertical compensation and slight lateral compensation should be the rule in good stress-breakers. They should be used with clasps only where it is undesirable to transmit the stresses of mastication to the abutment.

Another source of overloading abutment teeth is the use of improperly planned and made occluding surfaces. Caution is urged to keep the planes of occlusion at a height so that they will do their work but will not strike with greater pressure than is essential for mastication and the proper arch relation. The area of the masticating surface should vary with the degree of stress that the tissues and abutments will stand, but the area permissible will vary directly with the extent of pits, fissures and rounded borders allowed for escapes. Surface contact increases greatly the load over that possible of being applied where an approach to line and point contact is used. This is one of the reasons why better correction of occlusion may often be obtained by building up or shoeing the natural teeth. Grinding of already worn teeth increases the broad surface contact and eliminates escapes, and any effort to round off the edges for escapes removes the enamel and invites more rapid wear. Convex cusp planes allow more ready escape of food and less actual contact than concave cusp surfaces. If relatively deep grooves and rounded borders and crests are developed, only about half of the total length of the cusp or cusp excursion is actually coordinated with the condyle paths and other guidance, and errors in coordination are less annoying. Wide variation in the relative hardness of materials used on occlusal surfaces is another cause of the development of trauma and should be avoided or constantly observed and checked up.

Discordant articulation is a factor in gingival irritation. It is my firm belief that, because we are most concerned

with the restoring of lost units of the masticatory apparatus, in order to gain the utmost efficiency compatible with reasonable comfort and a reasonable development of esthetics and still conserve the vital peridontal membrane from serious injury, a balanced coordinated occlusion, when possible, and coordinated occlusion, if balancing is impossible, will be more desirable. The question as to whether the cusps originally guided and were responsible for the condyle path resulting, or vice versa, has no bearing in making restorations of any type, and certainly not in partial dentures. We should be more concerned with the peridontal tissues than with the correction of asymmetry in facial contour, condyle paths or muscle development and action. Asymmetry that is resulting in pathologic conditions of associated tissues and areas is usually progressive in magnitude and must be arrested, and often corrected to a greater or a lesser extent. This correction can be accomplished as readily by coordinated or coordinated and balanced occlusion as by arbitrary occlusion. The difference being that, in one, there is immediate coordination between cusp planes and the occlusal plane and the condyles, when coordinated occlusion is developed; and with arbitrary occlusion, there must occur (if we grant that it is possible) a period of discordancy between the cusps and the condyle planes and muscle action, until such time as the condyles and muscle action are coordinated to arbitrary occlusion. If the cusps must guide to the extent of developing new muscle action and changes in bone surface, added work will be placed on the support of such cusps, be it peridontal membrane or mucous tissue. After asymmetric development of bone contour of the face has developed, can asymmetry of muscle action ever be entirely restored? Central occlusion is the position assumed in swallowing and in the start and close of any occlusal movement; hence, with any method of developing occlusion, correct central occlusion is very important. The damage resulting from any cusp developed, be it convex or concave or straight, will vary directly, (1) with the intimacy of its opposing surfaces, (2) with the length, (3) with the area, and, last, with the correctness or degree of coordination of the angle. For example, the centrifugal action introduced in grinding long concave arbitrary cusps defeats the lack of coordination in direct ratio to the discrepancy in cusp occlusion developed. Slight failure in getting accurate coordination of long intimate opposing cusps is more disastrous than with very short line and point contact on slightly convex cusps, even if they were not so closely coordinated. The use for adults of 20 to 30 degree cusps properly relieved by grooves and rounded borders reduces all forces of mastication to a minimum.

It is easier to develop a safer, coordinated occlusion by opening the bite and shoeing cusps than it is by grinding cusps or leaving the bite closed, because the occlusion can be idealized to a greater extent by cutting down overbite; lowering and shortening the cusps if they are steep, and lowering the curve of Spee. For greater detail of this type of occlusion, reference is made to a paper read at Albany, May, 1925, published in the state society journal.

When making smaller restorations, when shoeing is not possible, the occlusion of all remaining natural teeth is first corrected by the use of study models mounted on an articulator of

the Hanau type or kineoscope and the restoration built with cusps that coordinate or are a trifle flatter. It is not sufficient to coordinate the cusps or restorations to those of opposed remaining natural teeth as the natural teeth may have developed trauma due to wear or poor dental work. Carbon paper is not always accurate as a guide, as teeth loosened by trauma may move and compensate, thus failing to register a carbon marking.

Do not forget that as long as the curve of the occlusal plane compensates, it is possible to develop, for any given condyle path, almost any cusp angles desired, from exceedingly steep long ones, down to absolutely flat occlusal surfaces, with no overbite or cusps of any kind, and still coordinate perfectly at any point between the two extremes. Therefore, considerable discretion is allowed the operator in building up a plan of occlusion or in tearing it down by excessive grinding. Study this from both an ideal and a practical standpoint. The two are not always compatible.

Unopposed torques, the last cause of peridontal irritation is frequently overlooked. It most frequently accompanies the use of clasps for retention, but may develop also from improperly positioned vertical stress-breaking devises, especially those whose parts fit together with but slight lateral play. When caused by the use of stress-breakers, whether extracircumferential or intracircumferential, it may develop from two causes: either two stress-breakers may not be parallel and, when settling, cause lateral pressure on one or both of two abutments, or both of two abutments may be parallel and yet neither one be parallel to the line of settling under stress.

Clasps which, because of insufficient bearing above the greatest diameter or because an occlusal rest was deemed undesirable, can thus settle on the tooth, when connected rigidly to the saddle, can develop lateral torques in this new settled position, unless precautions are used in planning. The remedy for such clasps (those able to settle down on the tooth) is to bear on as few surfaces as necessary to do the work and plan them so that bearing, to begin with, is near the occlusal end of surfaces parallel to the line of settling under stress for a distance that the clasp may be expected to settle. To explain: A clasp for a certain purpose need bear only at two opposite short spaces, and therefore can be separated from bearing on the tooth at all other points and be short in its length. Two such opposite surfaces parallel to the line of settling under stress may be found opposite buccolingually, mesiodistally or in any other direction through the tooth.

Surfaces parallel to the line of settling under stress are more apt to be chosen if the model is so mounted in the marking device that the plane of occlusion will be at right angles to the line of settling under stress instead of at right angles to some line of direction chosen as the line of greatest ease in placing the restoration in order best to clear tilted abutment teeth.

All abutment teeth whose long axis is tilted by drifting or other cause should be gripped rigidly; otherwise, downward pressure will cause further tilting.

All clasps should be bent to fit the necessary surfaces accurately at the time of making on the model, and not partially on the model, to be completed in the mouth, as it is very difficult to

determine the degree of tension when fitted in the mouth.

Wherever surfaces not parallel to the line of settling under stress must be gripped or where settling would develop bearing on inclined tooth surfaces, a rigid grip, such as cast clasps give, or occlusal rests or other means must be used to prevent such settling.

Clasps must grip sufficient tooth surface also so that the tooth cannot rotate or drift or tilt under the influence of clasp bearing. Clasps must bear at sufficient points opposite in a horizontal position through the tooth; otherwise, pressure near the occlusal plane on one side and near the cervix on the other would tilt the long axis.

If chemicobacterial action and the deflecting action of a clasp are eliminated and both of these can be counteracted by careful planning, proper choice of cases and systematic prophylaxis, there is no reason why an extracircumferential clasp attachment should damage the periodontal tissues any more than an intracircumferential, provided the same rules for care in planning and making are used. The clasp requires more care because of the greater number of bearing surfaces to be watched, but is usually given less care.

SOME COMMON DEFECTS IN OPERATIVE RESTORATIONS CONTRIBUTING TO THE INJURY OF THE SUPPORTING STRUCTURES*

By A. W. BRYAN, D.D.S., Iowa City, Iowa

AT first thought, an operative restoration means to us the placing of filling material in an existing defect in order that we may arrest the progress of caries. Dental practice was founded on this basis, and the efforts of the early practitioner were centered on this point. As dentistry advanced and operators became more skilful and farsighted, another factor entered into the art: the restoration of the tooth to function. While before, the operator had been content to arrest caries and prevent further destruction of tooth structure, he now realized that it was entirely possible also to restore the tooth to virtually its former usefulness by building the restoration to original tooth form.

At the same time that these things were accomplished, something much more important was automatically taken care of: the protection of the supporting structures of the tooth. As a result of this, the tooth was saved for many more years of useful service than would have been possible if the only idea in mind had been the arrest of caries. So we must keep constantly in mind that the dental restorations we make have a twofold purpose: the restoration of the tooth or teeth to function and the protection of the supporting tissues from injury.

Considering the function of the tooth purely in terms of masticating efficiency, many restorations will fulfil the

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first requirement to a fairly satisfactory degree but fail miserably when considered in relation to the second. But in considering the functions of a tooth, we must look beyond the mere matter of mastication. Nature has so designed and built the teeth that their very form plays a vital part in maintaining the health of all oral tissues. It is only necessary to examine carefully many restorations which at first glance appear to be acceptable fillings with good margins and beautiful finish to see plainly that they are doing more actual harm than good by failing to protect the soft tissues and alveolar process from trauma. The original tooth form did protect these tissues perfectly (provided we had normal alinement of the teeth), and we have failed in our operation if we do not reproduce these protective features in our restoration.

There are two types of injury to the supporting tissues which may be traced directly to errors made in dental restorations. The first type is injury caused to the soft tissues and alveolar bone owing to failure to restore proper contour for guiding food material. Nature has provided the necessary factors in tooth form to cause the tissues to be massaged and stimulated by the proper direction and passage of food material over them during mastication. Any change of form in our restoration diverts the food in the wrong direction, and irritation and destruction from trauma and food impaction result. This destruction not only is evident on the soft tissues but is even extended to the bone, especially in the septal region.

The second type of injury, which is manifest in the peridental membrane and the alveolus, is due to defective occlusal contour and excessive occlusal stress. By this, I do not mean that excessive stress is always delivered in line with the long axis of the tooth, for the fibers of the peridental membrane are arranged to withstand great stress in this direction. But excessive buccolingual strain, due to wrong inclination of slopes of inclined planes, is soon followed by injury to the peridental membrane and alveolus. This also indirectly affects the soft tissues, for, as destruction of the alveolar border takes place, the soft tissues recede and exposure of the cementum results.

The object of this paper is to consider some of the essential points to be kept in mind in regard to restoration to tooth form and to call attention to some of the common errors seen in many fillings.

Much stress has been laid on the contact point and its importance in protecting the septal tissues. When we hear the term "contact point," we immediately think of the contact between two teeth in the same arch. Another contact involved in all proximoclusal fillings is the "occlusal contact," which is just as important as the proximal contact.

We will now discuss the proximal contact and leave the occlusal for consideration under occlusal contour. The proximal contact is the common meeting point of all the embrasures, and their shape is determined by the location of this point. In fact, the embrasures are so intimately related to the contact point that it is wise to discuss them together. A mistake is often made in considering a tight contact as a good one. Contact alone is not sufficient to protect septal tissues from food impaction, and it is only when it is built in correct relation to other phases of tooth form that it will

do its work effectively. The marginal ridges and the embrasures must be properly formed or a tight contact is soon lost through wedging of fibrous food, and the destruction of the delicate soft tissues begins. It is possible for contacts on inlays to be so tight that, at first, it will be difficult to pass a ligature, but if other factors are not right, the contact is soon lost.

We know that, in the bicuspid and molar regions, the contact point is located well toward the buccal extremity of the proximal surfaces, giving a short buccal embrasure and a long sharp lingual embrasure. Many times in carving or finishing our restorations, we move this contact lingually; in fact, some schools teach this procedure. As a result, the shapes of the embrasures are changed, and the septal tissues are exposed to trauma. In a normal embrasure, food glances from the side of the gum septum without injury, acting, in fact, as stimulating massage; while, in the changed embrasure, it strikes the tip and causes trauma.

The gingival embrasure should be restored to true form by giving normal shape to the proximal surface of the restoration. Many times this is possible only after a period of separation to regain lost space. Failure to do this causes impingement of the soft tissues.

The occlusal embrasure is often neglected but is very important. The contact point is not placed by nature at the occlusal extremity of the proximal surface, but at varying distances gingivally to it. This embrasure is important in the part it plays in cutting food. With it, the contact acts as a knife.

The marginal ridges are important in that they aid the contact point in protecting the septal tissues. The mesial and distal marginal ridges are heavy bands of enamel that are emphasized by the fossae and grooves and the occlusal embrasure. They might be compared to a dam in a stream, since they keep the bulk of the food from going directly to the contact point by guiding it buccally and lingually (with the help of the fissures), allowing it to pass through the embrasures. In this way, the soft tissues are massaged, and the food is thrown back onto the occlusal surfaces by the cheek and tongue for further grinding.

Restoration of the line angles to original form is another important factor in maintaining the health of the oral tissues. This point is well illustrated in those line angles on all bicuspids and molars, which are full and sharp. We will take for an example the mesiobuccal line angle on the upper first molar. Many times, caries has progressed so far that the buccal margin of the proximal portion of the cavity must be located well past the line angle on the buccal surface. In this case, the error is often made of trimming the wax too short on the line angles, or the matrix for an amalgam filling reduces the contour of the filling to such a degree that the shape of the buccal embrasure is radically changed. In the natural tooth form, the sharp, prominent mesiobuccal angle guides the food so that it strikes the gum septum on the side for normal massage. But when this prominent contour is not restored, injury is sure to result. I consider the failure to restore the contour properly on the line angles responsible for almost as much damage as faulty contacts.

At first glance, the occlusal surface of a bicuspid or molar looks as if its grooves and fissures had been placed indiscriminately with no regard to function; as if the lobes simply happened

to unite at this point or that point. But nature had a scheme in the location of grooves and fissures. A careful study of these markings, as pointed out by Dr. Prime, demonstrates that every one has its purpose: the guiding of food in the direction that best assures the proper grinding of food and, above all, the protection of the supporting structures. The pits and grooves emphasize the marginal ridges and act as sluiceways to divert the food to the buccal and lingual embrasures. Nature is a shrewd architect.

Occlusal contour determines the amount and direction of stress on the peridental membrane during mastication, and it is of tremendous importance to see that our restoration is finished with this point in view. Many of the sensitive areas of exposed cementum are the result of improper occlusal contour in restorations placed some time before. The fibrous changes occurring in the peridental membrane, as demonstrated by Box, are associated with this same type of stress. It is now well recognized that these changes are the forerunners of the more advanced symptoms of periodontoclasia.

When it is necessary to restore a large part of the crown, care must be used to give proper contour to buccal and lingual surfaces. The height of contour is restored, as so well brought out by Friesell, and thus the marginal gingiva is protected from trauma by food.

The finish of the restoration is important in that overhanging, rough margins, or a surface without a high luster, favor salivary stasis and the lodgement of food material, with resultant fermentation and chemical and bacterial irritation to soft tissues.

Careless operating should not go unmentioned in this paper. Injudicious use of separators, files, strips and pluggers is responsible for much injury which may seem trivial at the time but leads to serious results.

We have attempted to show in this paper that failure to restore original tooth form in our restorations is accountable for a large part of the injury to the supporting structures, both marginal and deep, of the teeth.

FUNCTIONAL FREEDOM NECESSARY FOR THE HEALTH OF ABUTMENT TEETH IN BRIDGE AND SADDLE RESTORATIONS*

By EDWARD B. SPALDING, D.D.S., F.A.C.D., Birmingham, Michigan

IN 1871, a book entitled "Treatment and Prevention of the Decay of the Teeth" by Robert Arthur, M.D., D.D.S., caused considerable discussion in our profession. The main idea of the book was artificial separation by grinding away the points of bearing or contact with the other teeth for the prevention of decay; in other words,

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the changing of the anatomic form of each tooth and its relation to its neighbor. A clergyman under whose eye the book came remarked: "What a pity the Lord did not know about that in the first place."

Not all the impositions to which the teeth have been subjected have been confined to the mutilation of their crowns and the enamel. Evolution has developed a tooth for a definite function, but no part of Nature's plan seems to have prepared it as a rigid hitching post for an artificial denture, and its use as such is usually attended with ultimate injury to its supporting structures. Nature is kind and makes an effort to compensate for an unnatural condition; but to her patience in compensating for this imposition, there is seemingly a time limit, which is much shorter than the normal life of the tooth.

It is intended that the function of a tooth be performed while it is "standing on its own feet," or rather in its own socket. In a normal arch, each tooth receives from and gives assistance to its neighbors during mastication, by standing shoulder to shoulder with them, taking its share of occlusal thrust, but there is no unyielding attachment to an approximating tooth.

When teeth come into occlusion, the first impact is attended with a yielding or slight give. If this were not so, the natural crowns of the teeth would be fractured. We all know that a fixed bridge which lacks the yield of individual teeth must have its pontics made of metal, and that porcelain facings, if used, must be protected with metal, to prevent their fracture.

The individual action or movement of a tooth in occlusion stimulates healthy circulation in the supporting structures as the swaying of a tree encourages the flow of its sap. Any restriction of normal tooth movement impedes this circulation in the periodontium, tending toward atrophy. John Burroughs said: "Every part and organ and movement of a living body serves a purpose to that organism."

Twenty-five years ago, the early disciples of Edward H. Angle and Calvin S. Case used rigid retaining appliances in orthodontia cases after establishing occlusion. We are told that, after these appliances were removed, the teeth were found to be very loose. Being moved to new positions, they had not been able to build adequate support about their roots, owing to the rigid retaining appliances which prevented normal functioning and active circulation in the parts. Today, the orthodontist uses an appliance which gives all possible freedom to the teeth without allowing them to drift, thereby inviting the establishment of a healthy periodontium by functional activity.

We note that a tooth out of occlusion through loss of opposing teeth becomes loose; but if occlusion is properly reestablished, it soon regains its normal condition. It requires function to keep a tooth in a state of health. We know also that excessive use and overload of a tooth is fully as disastrous as lack of use. Some one has said "Occlusion is the basis of all dentistry," and we are certain that many cases of bridge and saddle restorations become failures

simply through inattention to proper occlusion.

Another factor which endangers the health of an abutment tooth lies in its being held so rigidly that, when it comes into occlusion, it yields only partially, or under restraint. This restrained action is found in a fixed bridge where the pontic is soldered to each abutment. This may also be true of a removable bridge that is retained by rigid attachments.

After a clasp bridge has been worn for a few months, an examination of the teeth wearing the clasps will usually evidence a mobility not present when the bridge was first placed in the mouth. This may not mean the loss of the teeth in the immediate future, but it does indicate an abnormal condition, and often a feeling of discomfort to the wearer. We have noted many instances of either fixed bridges, or removable bridges which were rigid when in place, where there was much mobility in the abutments. On replacing the bridges with a type to break the rigidity, the abutment teeth became normally firm.

A rigid attachment of a bridge to a tooth may do two things: it may give it an abnormal pull, a pry or a torque, which results in excessive mobility, or it may hold it so rigidly that, when the tooth receives the impact of occlusion on its inclined planes, it cannot yield, and the whole force is delivered vertically in line with the root, driving the tooth into its socket, with resultant shock and trauma. In a single act of occlusion, an abutment tooth may first receive pull or strain from an unnatural direction, and, in the latter part of the act, be held so that it cannot yield in the direction which would be its normal right. An effort to correct such a condition by grinding the occlusion may free the tooth but deprive the bridge of the use for which it was constructed.

If we place our thumbs over the palatal surfaces of the upper bicuspids and molars in our own mouths and press forcibly outward as if to spread the arch, we can feel a preceptible spring to the arch. Not only do the teeth yield but the whole maxillary bone also gives evidence of its elasticity. In the act of mastication, when the buccal cusps of the upper teeth on one side, say the right, first come into lateral occlusion with the lower, the teeth on the opposite side are not in occlusion, or at least have no stress put upon them. To the side in occlusion, there is a distinct outward yield of the teeth and maxilla as the lower teeth slide down the inclined lingual surfaces of the buccal cusps of the upper teeth.

Let us consider a frequently used removable restoration for several teeth missing in the upper arch with a rigid palatal bar held by unyielding attachments, such as clasps, to teeth on both sides. When the teeth come into lateral occlusion on the right side, they are deprived of their normal yield buccally, and also a lingual pull is exerted on the attached teeth on the left side when they should be at rest. Experience leads us to expect undue mobility in the clasped teeth on either one or both sides of the arch. If there is no abnormal mobility, then we look for clasps that are slipping on the teeth, and the employment of loose clasps without occlu-

sal rests is taught as good dentistry by some. As compared with a tight clasp that produces injurious leverage on a tooth, the loose one would possibly be the lesser of the evils.

The fact that a bridge restoration is tolerated by a patient does not indicate an absence of slow destruction about the abutments; for we see all stages of periodontoclasia with freedom from complaint on the part of the patient. If Nature's warnings did not so easily cease to be registered, the life of the teeth might be prolonged, for the destructive influences could be recognized and be corrected.

Unfortunately, to determine just how successful a certain type of bridge may be, observation of many cases over a period of years is necessary, and it is difficult to collect data concerning each case. Clinical observations must necessarily vary, being dependent on the opportunity of the observer and also on whether he may, or may not, be biased in favor of some particular type.

During the past year, a well known advocate of the fixed bridge, a man who has taught its use extensively, admitted that a fixed bridge that had a movable joint at one end was more comfortable to the patient than one fixed at both ends. An argument for more freedom, was it not? He also advocated the supplying of two lower incisors by rigid attachment to the lateral incisors, remarking that, while the lateral incisors might not last more than five years, we could then attach to the cuspids. Seemingly, that was an admission that either overloading or restricting the function of the lateral roots would bring about destruction in the periodontium.

There will always be an effort made to supply missing teeth, and the remaining teeth in the mouth will be called on to assist in the retention of the artificial ones, but at what price? Is not time the measure of the cost? When we place a bridge in the mouth and call on two or more teeth to assist in its retention, do we not ask ourselves how long that will function before there is evidence of a weakening of the abutments? If we are newly graduated, the polish on the metal dazzles us and we close our eyes with satisfaction, but if we have been observing bridges from twenty to thirty years, there is always the question. We are merely trying to bring out the point that a bridge does establish an unnatural condition, though both patient and operator may be willing to pay the price.

We see some rigidly fixed bridges that have done service for years with evident comfort to the patient, but, on examination, we find that the span is short, the roots are long, the alveolar process is heavy, the occlusion is very nicely adjusted and there is a distinct compensating yield in the opposing teeth. Nature could compensate here for restriction of natural tooth movement. But with a fixed bridge having a longer span, a greater load on the abutments, shorter roots and a less heavy alveolar process, coupled with restriction to the roots so that the normal blood supply could not be stimulated by function, the prognosis is not good. We are considering bridges attached to normal healthy teeth. Employment of a bridge as a splint to

purposely stabilize weak teeth having too much mobility is another subject.

The type of bridge known as movable-removable has much in its favor for supplying one, two and sometimes three teeth in a single space. It offers a saddle that not only takes some of the load but also, on account of its slight mobility, affords a gentle massage to the mucosa, which seems to be of much value to the underlying structures; a point on which there is a difference of opinion.

As an indication of its yield in occlusion, a full porcelain pontic, supported by the saddle, may be used with little danger of fracture and yet it functions well in mastication. The attachments may be applied to vital teeth, and the bridge, being removable, is cleanly. The greatest advantage is the freedom allowed the abutments to function independently. We feel, after observing a number of cases of this type of restoration over a period of several years, that, where its principles are correctly understood and carried out, there is a better state of health about the abutments than is usually found about a fixed bridge.

The full tissue bearing saddle is being more frequently used as a means of replacing lost teeth and more successfully, owing to the many stress-breaking devices that have appeared.

An accurate fitting and properly functioning saddle rarely requires rebasing; for intermittent moderate pressure on the mucosa builds firm tissue. It is either lack of stimulation by massage, or constant and excessive pressure, that causes absorption.

The ideal retainer and stress-breaker should hold a saddle constantly in light contact with the mucosa, allowing the saddle under load to compress it, and without leverage or restraint to any of the natural teeth. Such a retainer should be easily placed in position and removed from the mouth without subjecting the teeth to strain.

Without discussing the qualities of the various stress-breakers, we will mention only one, a modification of a very old type, which, after observation of several cases for over a year, seems to give much promise.

The principle is a ball which is attached to the retaining tooth by some suitable means, possibly an inlay or a three-quarter crown, and a split tube, in which the ball freely plays, and which is attached to the saddle. When the saddle is in place in the mouth, there is a latch which closes the end of the tube so the ball cannot be disengaged, and the saddle cannot raise from the mucosa but can compress it in occlusion. The abutment tooth seemingly has no restraint in its own occlusion and evidences no resentment at the attachment to the saddle. When the latch is opened, the appliance is removed from the mouth with no pull on the abutment tooth.

If we feel that there is anything to functional freedom of the teeth, we will continue to study for means to free them; if not, then we will admit that Nature has made a mistake and continue to make bridges after the principle of Dr. Richmond, who originated the gold crown some forty years ago and taught us to fix rigidly all abutment teeth and take away their right of freedom to function.

COORDINATING THE MECHANICS OF BRIDGE CONSTRUCTION WITH THE BIOLOGIC REQUIREMENTS OF THE PERIODONTAL STRUCTURES*

By JAMES KENDALL BURGESS, D.D.S., New York City

THE sooner we, as a profession, comprehend the true nature of the human denture, the sooner we shall be able to solve some of the problems that remain vague and controversial. As elemental as this may sound, experience and observation give reason for believing that we have not yet come into such complete understanding.

The denture is, first and above everything, a piece of mechanism, a distinct mechanical apparatus, designed for a specific mechanical service. The fact that it is a part of the living organism—a human organ—and, by reason of its location, a dominating influence in the general facial harmony, does not in any wise alter that status. If we are to assume the responsibility of its intelligent care, therefore, we must do just what the craftsman in any other calling must do: We must know the nature of the mechanism with which we deal; the materials of which it is constructed; the conformations and arrangements of its parts; the service it performs and the *modus operandi* by which it performs that service. Likewise, we must know what constitutes a normal service; any variation, plus or minus, from that normal, and the influence, possible or probable, on the mechanism of such variation. We must understand the care of the apparatus as it relates to those influences, chemical and mechanical, that conduce to its welfare on the one hand and its degeneration or disorganization on the other. Since this discussion is concerned, in the essence, with the prophylactic care of certain of the tissues that compose the dental apparatus, it seems reasonable to assert that the application of these items of basic information will go a long way toward solving the problem. The dental mechanism, for the purpose of this study, may be divided into two parts: the service units and the foundation into which they are anchored. And since the service units require for their functioning a certain stability, and since they are dependent for this required stability on the integrity of the foundation, it is patent that a knowledge of the materials of which the foundation is constructed, and of their reaction to the influences brought to bear on them under the varying conditions to which they are subjected, is of paramount importance.

These materials are, first of all, vital tissues of character in general with that of the other tissues of the human body, dependent, as they are, on the vital processes of the body for the maintenance of their integrity, and subject, in like manner, to degeneration, dissolution and disorganization as a result of any disturbance of these vital processes. They are divided into two general classes: the

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hard or bony structures and the soft or vascular tissues. Of these, the bony structures constitute the frame work, furnish anchorage to the service units and bear the ultimate stress of the service they perform; while the vascular tissues overlie and line the bony structures and exercise, among others, the functions of nourishing and protecting. To my knowledge, the bony structures are not subject to any primary lesions within the scope of these considerations, such morbid and destructive changes as occur in them being the secondary results of primary disturbances in the vascular nourishing and protecting tissues. It is evident, then, that if we would protect and conserve the status of these bony supporting structures, we must protect and conserve the status of the vascular tissues through which they are influenced for good or ill. Here is true prophylaxis; and the foundation demands and deserves prophylactic consideration.

What are the influences, then, against which these tissues must be protected? All such influences as they pertain to any mechanism in or out of the organism may be classified under two general heads: chemical and physical. Since this discussion is concerned with the periodontal tissues in their relation to oral restoration, it is not pertinent to consider chemical reactions and physical disturbances originating in the organism itself through faulty metabolism or other deviation from or interference with Nature's normal function and processes, and conformations and relations. Coming to matters pertaining strictly to oral restoration, let us examine the foundation materials with which we are concerned—the vascular tissues—and the influences on them of those forces, chemical and physical, that eventuate as the results of our reconstructive efforts. These tissues are two in number: the gingival and the peridental membrane; and they constitute two vulnerable areas that are related to two distinct phases of our operative procedures. Being vital tissues, they are dependent upon the normal processes of the organism for their creation, development and maintenance. Their normal status requires only that these normal processes remain undisturbed; conversely, whatever disturbs the normal processes to however slight an extent is inimical, in commensurate degree, with their welfare. It is evident, then, that our constructive program must be conducted with this fact as a guiding factor. There are three factors in this constructive program to be considered: the plan, the execution and the materials of which the restoration is constructed. Let us consider these in reverse order, taking first the structural materials. The unfavorable chemical action of the body fluids and secretions on otherwise available base metals and unsuitable materials, rendering them incompatible, is so universally understood that only the veriest charlatan would employ them in this connection. Materials in legitimate use are not subject to such unfavorable chemical action. Their presence, therefore, exercises no direct disturbing influence, chemically, on the materials in our foundation structures. The only such influence to be guarded against is an indirect one, the decay of food débris, made possible by the ill-advised relations and inaccurate adjustments of poor craftsmanship, which facilitate its accumulation.

This brings us to a consideration of the physical influence of the structural

materials on the materials in the foundation, the vascular tissues. Here, given the structural materials, we come to the second factor of the constructive program—execution.

That these structural materials must, in frequent cases, be placed in direct relation with the vascular tissues is inevitable. Whether the influence of this physical relation be benign or disturbing will depend on two conditions, which may be designated as qualitative and quantitative.

By qualitative, the character of the surface and terminal margins of the structural materials brought into this physical relation is meant. By quantitative, the character of the relation itself is meant; whether it be one of mere contact or one established with sufficient force or pressure to alter the normal conformations and positions and relations of the vascular tissues. It is obvious that when the circumstances of our undertaking admit, it is better to avoid this physical contact altogether and eliminate entirely the question of its influence. Where this is not practicable it may be stated as a general proposition that such surfaces and terminal margins, free from inequalities, which is to say, smooth surfaces and properly curved, blade-like margins that follow the outline and occupy the relation of mere contact with the foundation tissues that curve about the cervix of the abutment units, alter in so slight measure, if at all, the physiologic processes in these tissues that they exercise an influence so little disturbing as to be practically nil. Any departure from this ideal of smooth surface, properly reduced, curved margin and mere contact relation, through the placement of rough surfaces, jagged or thick margins or both, or the production of pressure beyond mere contact, either by extension into the tissues beyond the gingival margins or the distention of these margins or both, exercises, through such alteration of the physiologic processes in these tissues, a disturbing influence commensurate with the deviation from the normal, which they establish in their conformations, position and relations. These are matters which pertain, in simple terms, to the proper preparation of abutment units to receive attachments and the proper selection, construction, adaption, relation and finish of these attachments, and which, for practical purposes, may be reduced to the laconic: Fit and finish.

It has been a much discussed question whether the crown band should telescope the tissue margins or terminate short of them. Time does not suffice to elaborate on the statement that if this imperative principle of fit and finish be observed, the matter is comparatively unimportant. It should be obvious to the merest tyro that fit demands as a precedent preparation by the correction of contours and irregularities to an extent that leaves that portion of the abutment until to be engaged by the attachment with its greatest circumference at the terminal margin of the attachment. Perhaps, the most serious menace to these vital foundation tissues in all restorative dentistry, and not only the most degrading institution to a so-called profession, but also a disgrace to even elemental mechanics, is the type of tissue-destroying shell crown that passes in constant review. If quality of workmanship is a consideration, the perpetrators of these devasting monstrosities could not gain membership in a plumber's union.

Another physicial influence disturbing to these vital foundation materials arises through a different type of incoordination, i.e., failure properly to relate the attaching devices—crown or what not—on their proximal sides to adjacent service units, thus leaving spaces into which are crowded shreds and particles from the nutrient mass during the grinding process, with resultant pressure beyond mere contact against the vascular tissues and the alteration of the vital processes necessary to the maintenance of their normal status. The evil is a very prevalent one, and the sequelae are of serious import. The remedy is too obvious to need discussion here.

This brings us to the second vulnerable area: the cushioning membrane that lies between the imbedded portion of the service units and the hard structures of the foundation, and serves the purpose, among numerous others, of protecting both from the destructive influence that the impact received in the operation of the mechanism would otherwise impose on them. This membrane, like the gingival structures, is a vital tissue and, like them, dependent on the vital processes of the body for its existence and its status; and whatever alters these processes disturbs its status. The disturbing influence to this area is physical but of still another type. Service is produced through force or stress, and stress demands commensurate resistance, both of which must pass through this membrane before they can reach the hard structures that must ultimately bear their weight. In Nature's normal, these reciprocal forces—stress and resistance—are properly coordinated. In the disorganization of the mechanism through the loss of units, this coordination is lost, and the menace to this area arises through the failure in our reconstructive efforts to reestablish it. Thus, we have a degree of stress on the superstructure overbalancing the measure of resistance in the foundation, or overloading, producing compression, not only beyond Nature's normal but beyond a certain latitude or tolerance that Nature provides, an alteration of her vital processes and a commensurate disturbance with its sequelae, to this foundation material or tissue itself. This evil relates to the third factor in our constructive program—the plan of the restoration rather than its execution—and is the result largely of poor judgment, or none at all, in the exclusion of available units that should be included in the abutments. In my own observation, whatever the number of supplied units in a given bridge span, it is rare to find more than a single unit in the abutment at either end, where, in all but rare cases, not fewer than two units should be included, at least in the forward or anterior abutment. In a great majority of cases, this one additional unit is the margin of safety between failure and success as it relates to this phase of reconstruction.

In recent years, it has been found necessary to reduce traffic over two great bridges that span the East River in New York City. In one case, it had increased beyond the load that the bridge was constructed to bear, and in the other, the construction was found to be inadequate to carry what the plan intended. Both conduced to the same result—overloading. The difference between an undertaking such as the Brooklyn Bridge and a bridge for the oral cavity is entirely one of size and detail. The fundamental engineering principles of plan and exe-

cution are precisely the same; and the dental restorationist who has not learned this vital fact or does not understand it is not mentally equipped for such an undertaking.

Here, we have the menace of three physical influences that are disturbing to the foundation which we must protect if we would conserve the mechanism dependent on the integrity of the foundation for its continuance in service: direct injury to its tissues from careless or incompetent use of structural materials; accretions into unprotected parts of the mechanism, and strain on the mechanism itself in service through lack of coordination and consequent overloading.

I have avoided, as far as possible, anatomic, physiologic and other biologic terms in the effort to present this important matter purely in its mechanical aspect. If we are going to practice the profession of dentistry, and whether we desire to be considered surgeons, artists or what not, we must, above everything, be mechanics. There is no disparagement here; the tragedy lies in the fact that so many of us, whatever else we may be, or desire to be called, are not mechanics.

Whether or not a discussion of the pulp and its extra-apical relations and influence should be a part of these considerations, the time allowance will not admit of it. But I cannot refrain from one observation: If we persist in the butchery of vital pulps for mechanical reasons—if I may paraphrase James Whitcomb Riley—the microbes will get your foundation if you don't look out!

A DEFINITE RELATION OF THE PRINCIPLES OF RECONSTRUCTION TO PERIODONTIA, CONSIDERING GINGIVAL IRRITATION*

By T. W. MAVES, D.D.S., Cleveland, Ohio

SINCE the last international dental congress, the study of periodontia has been seriously undertaken by a comparatively small group of dentists with a wonderful vision and an immense hope that, through united efforts, order may come out of chaos and that prevention may supercede reconstruction. Perhaps in no period of dental history has there been better cooperation. We realize more and more that we are interdependent and that without a thorough knowledge of the principles of periodontia and a conception of its etiologic factors, it is an impossibility to build a reconstructive case that is truly restorative. "Restorative" is defined as "capable of renewing health or strength." What better goal would an idealist want for a piece of reconstructive dentistry, whether it be an inlay, or a complicated piece of bridgework?

Traumatic occlusion is now generally recognized as an important factor in the etiology of the various forms of

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periodontal lesions. The present conception of periodontology has greatly added to our knowledge of these pathologic conditions and has established itself as one of the fundamentals of dental practice. According to the best authorities, the etiologic factors in periclasia have been divided into two groups, primary or secondary, and one of the principal primary factors is malocclusion.

It is a recognized fact that all cases of traumatic occlusion do not produce like lesions in all individuals. There are some whose tissues at an early age show advanced lesions which result in congested gingivae, and marked pericemental and alveolar disintegration; while the gingivae of others in late middle age are of good tonicity with slight tissue wasting and the alveolar process practically in the same state as one may see in cases of natural atrophy which is the concomitant of age.

The lack of applied dental anatomy is one of the many causes of gingival irritation, and when we consider that we have around the necks of all of the teeth from 40 to 50 inches of gum tissue which we are accountable for, too much stress cannot be applied to occlusal anatomy, proper contact points, embrasures, solder points, interproximal spaces, and proper fittings around the necks of teeth. The success in reconstruction of the mouth first depends on the health of the underlying tissue and the absence of periodontal lesions, by the application of applied dental anatomy and also balanced occlusion.

Added to the foregoing are three common sources of gingival irritation: (1) any metal which tends to go beneath the free margin of the gum, no matter how perfectly it fits the neck of the teeth; (2) an exaggerated and too tight contact point, and (3) synthetic enamel fittings for gingival cavities and where intended to preserve contact of teeth. Can we imagine a greater source of traumatic occlusion when hundreds of inclined planes of all the teeth are placed in disharmony than exaggerated contact points and their loss by the latter two sources of irritation mentioned?

In a case of ulatrophia that shows progressive recession of the gingival tissue and exposure of cementum, malocclusion is more or less present, and if it has not hopelessly advanced, judicious grinding of the teeth to the best balance possible before any restorations are made is indicated and considered a sane procedure.

When malocclusion is pronounced, as is seen when there is a marked lingual inclination of the maxillary incisors or decided abnormalities, the problem can best be solved by the cooperation of the orthodontist, the periodontist and the specialist in restorative dentistry.

I wish at this time to commend the teachings and the fundamentals advocated by this section of our American Dental Association. No man can be successful in restorative dentistry without a complete knowledge of periodontia because the success and barometer of his work depends on the absence of gingival irritation, and periodontal lesions, and the health of the underlying structures. When it is necessary to restore the occlusal surfaces in order to obtain harmony and balance of the teeth, and when any lost member or members of the arch are to be replaced, the first essential is to make proper study models of the upper and lower arch in artificial stone or some hard material

and mount them on an anatomic articulator which produces the movement of the mandible. These cusps and incline planes which interfere with harmony are studied, and then, with this chart, the operator proceeds to the mouth and, with small stones, judiciously grinds the surfaces which interfere with the best balance and permit the greatest occlusal harmony, before attempting any restorative procedures. For the foregoing technic, permit me to refer you to Paul R. Stillman's article on traumatic occlusion.[1] He has given to the specialist in restorative work, as well as to the periodontists, one of the greatest and most important fundamentals; namely, the grinding of surfaces that interfere with occlusal harmony before periodontial treatment as well as restorative dentistry. I wish at this time to express my appreciation to Drs. Stillman, Bricker and others, for this fundamental principle, which has proved of real value in extensive cases and has aided decisively in the elimination of gingival irritation. J. Herbert Hood, a periodontist, has given me much help and inspiration in working out these problems.

If the foregoing procedure is not carried out before a mouth restoration is attempted, we shall be responsible for three errors. 1. If all the teeth to be restored to balance are out of occlusal harmony and are producing trauma, in the same proportion all restorations and bridges will continue to function in disharmony, and thus periodontal disease will be perpetuated. 2. Lengthening of the crowns of the teeth will be necessitated to obtain occlusal balance to a point which will increase lateral leverage and vertical stress, most dangerous to the underlying structures as well as to the teeth inclined in the restorations. 3. A resultant exaggerated dental structure will invite gingival irritation and periodontal disease.

Following the first set of casts, a second is made after the best occlusal relation of the teeth possible has been obtained by judicious grinding of the interfering occlusal surfaces, and these are mounted on an articulator for the study of those teeth to be restored to balance necessary for maintenance of health and function. At this point, the diagnosis and prognosis for restorative procedure is of vital importance to periodontists as well as to specialists in the crown and bridge work. We find the profession divided into two schools. On the one hand, we have men who proclaim the accurate reproduction of the temporomandibular movements as being essential to successful construction, and, on the other hand, we have those men who pay no attention whatever to the temporomandibular articulation, at least no attention within reasonable limits, but rather uphold the occlusion as the master of the situation. In regard to the latter or spherical principle, let us keep clearly in mind one definite fact in reference to restorations of all types as well as its diagnostic value in periodontia. This principle claims a spherical arrangement for teeth in skulls of the white race of the highest type of development. Both race and high type of development are two mooted questions in anthropology. Having no pure bred race, it is almost equally safe to say that there does not exist in our daily life an example of the highest type of development. The orig-

1. Stillman, P. R.: What Is Traumatic Occlusion and How Can It Be Diagnosed and Corrected? J.A.D.A., 12: 1330 (Nov.) 1925.

inal races of men have become blended by interbreeding until it is well nigh impossible to draw fine lines of distinction; and as for the highest types of development, we have external influences that tend to affect what might have been originally predestined to be a high type of development. Briefly stated, function influences form and use, both normal and abnormal, including overuse and lack of use, whether symmetrical or asymmetrical, and has its resultant changes in form. Therefore, if we are presented with a case in which only a few teeth have been lost, and it is determined to restore those lost members by means of bridgework, we cannot very well take for granted that, prior to the loss of those teeth, this particular individual's skull was of the highest type of development and uninfluenced by such external forces as excessive use of one side over the other. Therefore, the restoration of a mouth of this type to the spherical tooth arrangement would be a great error, and the desired end would be defeated. When casts are made for the detection of traumatic occlusion or cusp interference, and also for restorative measures, the spherical instrument can be used only on those cases that were at one time, or would be at the present time, in spherical arrangement had it not been for the one and sole disturbing factor that produced the cusp interference. On the other hand, if the patient belongs to a type in which the plane of occlusion and curve of Spee under normal conditions were straight or almost flat, with normal mesiodistal relationship, and the individual developed cusp interference resulting in periodontal disease, it would be a great error to bring these teeth to occlusion according to the spherical principle. It has been my observation that those cases in which the plane of occlusion was other than spherical, and the spherical arrangement was applied, traumatic occlusion, gingival irritation and lack of function were increased rather than diminished; also that in obtaining proper mesiodistal relationship in these cases, a locked occlusion resulted, which is to be avoided in remedying periodontal injury.

Let us now consider an important factor applied only to cases of balanced occlusion in which opening of the bite is to be considered for occlusal harmony. After five years of intensive study and research, the prosthesis society recognized the vast importance of centric occlusion in denture prosthesis and its registration by the Gysi gothic arch. F. M. Hight, of Houston, Texas, demonstrated its importance at the annual Session at Louisville, and, I wish to emphasize its use in any of the so-called open bite cases. The main reason for its application in restorative work is the exact occlusal harmony obtained from centric occlusion and the absence of vertical as well as lateral stress.

Let us suppose that centric occlusion, normal to the individual, was varied a fraction of a millimeter and the entire restoration was built to this error. All of the incline planes would be placed in disharmony, and trauma would be introduced, with the ultimate result of disease of the hard and soft tissues.

If we accept centric occlusion properly obtained by the Gysi gothic arch and modified by Dr. Hight, and not rely on any articulator, merely placing a thickness of material between the teeth, we shall have the right starting point

for any restorative procedure in open bite cases. We must note the centric occlusion in the individual, with the gothic arch tracing, and then transfer this record by means of the Snow facebow to an instrument which will indicate as nearly as possible the harmony between condyle paths, and the curve of Spee, normal to the particular case for which the restorations are to be made. When the teeth in the mandible are once separated from those in the maxillae, or the bite is to be opened, all accurate occlusal relationship is lost, this fundamental applying to crown and bridge open bite cases as well as those in which all the teeth are lost and are to be built up to proper balance and occlusal harmony. The occlusal relationship can be brought back to proper harmony only by the Gothic arch tracing as advocated by the best men in denture prosthesis; which applies as well for open bite restorations.

These principles are very important to the periodontist as regards diagnosis and prognosis, as well as to the man who attempts restorative measures, as he works with occlusal harmony in mind, to maintain the health of all periodontal tissue. Any tooth whose cusps are out of harmony produces abnormal stress during occlusal function, and this stress produces abnormal pressure against the pericementum, with resultant alveolar bone absorption and periodontal disease.

CONCLUSION AND SUMMARY

A thorough knowledge of the etiology of periodontoclasia and periodontal disease must be fully understood by men who attempt restorative dentistry, and success will be in direct proportion to the health of all underlying structures. On the other hand, the periodontist must recognize and demand, in these cases in which occlusal restorations are necessary, the adoption of occlusal harmony between condyle paths, the curve of Spee and the muscles of mastication, normal to the individual at hand, for proper function and lack of gingival irritation and disease. The dentures placed in that mouth should be adapted to the individual and not to some ideal in mind. The failure of certain cases in the hands of a few periodontists are directly due to the fact that they did not demand that the principles of dental anatomy and occlusal harmony, as well as balance, be applied.

A routine application of the principles of dental anatomy is one of the many causes of gingival irritation. The occlusal anatomy of a 20-year-old individual is not suitable to a 50-year-old patient. Let us construct the dental anatomy of teeth to be restored with the greatest possible harmony of condyle paths, muscles of mastication and the curve of Spee, and not in accordance with some ideal.

In those cases in which we are called on to open the bite and we lose all occlusal relationship between the teeth of the mandible and maxillae, the registration of centric or central occlusion by the gothic arch tracing is as important as the same registration of centric occlusion for full denture cases. The elimination of traumatic occlusion in a full mouth restoration, starting from a central point, normal to the individual, will give the greatest occlusal harmony to all incline planes, and the prognosis is favorable as regards gingival irritation and periodontal disease.

MOVING MALPOSED TEETH INTO PROPER RELATION TO LINES OF STRESS AND ESTABLISHING A BALANCED OCCLUSAL RELATION BY MECHANICAL RESTORATIONS*

By DeFOREST DAVIS, D.D.S., Minneapolis, Minnesota

THE responsibility for a large part of periodontal disease may be justly charged to all types of dental restorations. Lack of technical skill is perhaps the commonest cause, but, oftentimes, restorations of marked perfection and beauty are an active menace to the periodontium. This, I believe, is the result of failure to understand the principles governing the application and distribution of occlusal stress. G. V. Black demonstrated, a long time ago, that the teeth and jaws of the adult are called on to carry a remarkably heavy load. This fact makes the matter of stress one of primary importance in all dental reconstruction.

The modern dentist is most particular about the margins of his fillings, the gingival adaptation and contour of his crowns, the fit, occlusion and beauty of his bridgework, etc. None of these will save the tooth when the stress on it is greater than it can withstand. So it would seem to me that the objective in all dental reconstruction is to apply the stresses of occlusion in such a manner as will be conducive to the health of the periodontium.

This subject cannot be discussed fully here, but I should like to call your attention to the malposed tooth and its significance in periodontal disease. (Fig. 1.)

Normally, the individual tooth receives its load through its long axis. The upper picture in Figure 1 shows a normal set of teeth, each tooth being in its normal position in the arch and in normal relation to its opposing tooth. This arrangement is conducive to health because the stresses are properly applied to all the units individually and collectively. The lower picture shows what may result from the loss of a single molar. The second and third lower molars and the upper cuspid and lateral and central incisors have migrated from their normal positions. They are now receiving the stresses of occlusion at an angle which not only hastens their migration and the destruction of the periodontium but also makes it impossible for them to carry their full share of the stress. The bicuspids, being locked in position and unable to escape, are compelled to assume practically the entire load of occlusion. Thus, the loss of a single molar may so disturb nature's wonderful scheme of stress distribution as to jeopardize seriously an entire dentition.

It is the purpose of this brief discussion to emphasize the value of orthodontic assistance in moving malposed teeth back to normal positions in order to relieve the periodontium of a destructive load. This would apply

*Read before the Section on Periodontia at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 25, 1926.

particularly, of course, to teeth which are to be used as bridge abutments. It has been my observation that, frequently, an otherwise correct dental bridge fails because the abutments continue to migrate after the bridge is in place. This is true more frequently of removable bridges whose attachments are unable to stop tooth migration.

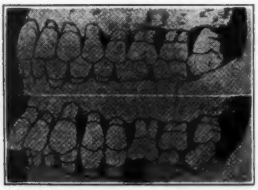

Fig. 1.—Below: Bone destruction, migration and closure which may result from loss of lower first molar.

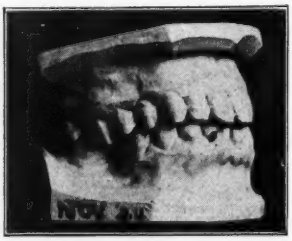

Fig. 2.—Change in position of all molars due to loss of lower first molars.

A practical problem which developed from the loss of the lower first molars and in which orthodontic treatment was used to prepare for bridge work is here summarized:

A woman, aged 26, a nurse of Scandinavian descent, came in for treatment. The lower left first molar and the lower right first and third molar were absent, the first molars having been extracted ten years before. (Figs. 2-3.)

Fig. 3.—Left side of model shown in Figure 2.

The second molars had migrated forward and lingually, and the upper first molar had extruded. (Fig. 4.) There was an extensive loss of bone around the upper second bicuspids and a less extensive involvement around the first bicuspids, cuspids and incisors.

The bony septum between the upper first molars and the second bicuspids

Fig. 4.—Abnormal position of lower second molars.

had been almost entirely consumed (Fig. 5), indicating, as I have stated, that when lower molars migrate, a large proportion of occlusal stress is transmitted to the upper bicuspids.

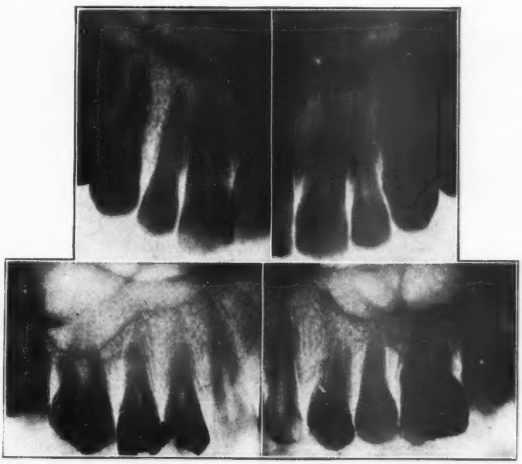

Fig. 5.—Loss of bone in upper arch caused by traumatic loading of these teeth.

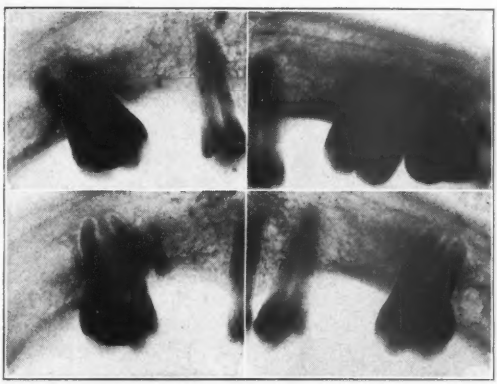

Fig. 6.—Above: Second lower molars moved to normal position by orthodontic treatment.

The patient came to have two bridges placed to supply the missing lower first molars. It was immediately obvious that this would be futile as it would not arrest the destructive process, which was already so far advanced. Study of the case showed that the only treatment worth while would be a complete rearrangement of the occlusion so that

the stresses would be distributed over the entire dental arch, enabling each tooth to assume its proper share. This could not be done without putting the

Fig. 7.—Lower arch restored by bridgework and orthodontia to a correct occlusal plane.

malposed molars to work by moving them back to their normal positions. The patient was placed in the hands of an orthodontist, who began his treatment at once. The upper half of Figure 6 shows what was accomplished after ten months of treatment. The lower picture was taken just before the orthodontic treatment was begun. It was found impossible to move the left

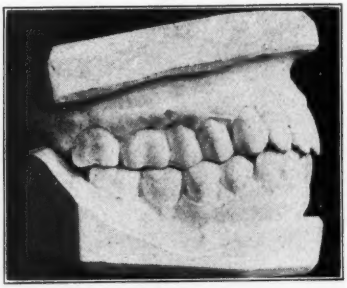

Fig. 8.—Right side of finished case.

second molar until the third molar had been removed.

After the orthodontic treatment was finished, a new set of casts were made. These were mounted on a Monson mandibulomaxillary instrument, which made possible the reproduction of the patient's mandibular movements. A plan was then made on the instrument to reconstruct the occlusion so there would be an even distribution of stress in all functional positions of the mandible. The mandibular teeth were first brought into a predetermined spherical arc by placing two fixed bridges, which supplied the first molars. (Fig. 7.) The abutments on the second bicuspids and second molars took the form, in

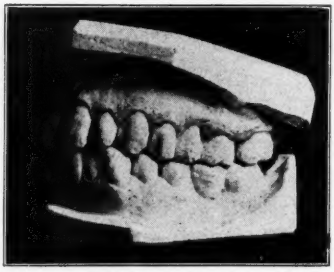

Fig. 9.—Left side of finished case. Decreased overbite and interdigitation of cusps may be noted.

part, of occlusal shoes which lengthened the teeth 1 mm., it having been found during the diagnosis on the instrument that these teeth were that distance below the spherical arc that would give the best balance. Figure 7 shows the lower teeth after reconstruction.

The reconstruction of the upper teeth, after the extraction of the second bicuspids and right first molar, involved two fixed bridges and an individual restoration on the left second molar. This brought the whole upper arch into a balanced relation with the finished lower. By balanced relation, one which provides a maximum occlusal contact

in all functional positions of the mandible is meant.

As a final step, the entire occlusion was then carefully milled with carborundum paste in the mouth to eliminate every slight point of interference.

The finished case (Figs. 8-9), while at best an attempt to reproduce nature's ideal, gives us reason to believe that the life of this dentition has been considerably prolonged by our treatment. The occlusal stresses are now distributed evenly over the entire arch, and each tooth, through its long axis, is receiving its load.

The surest test of any dental restoration is the condition of the periodontium. Our restorations should be made to provide the longest possible term of health. This invariably calls for a consideration of the entire dental mechanism in order to insure an harmonious relation of all its parts.

CORRELATION OF REPORTS ON "HOW MAY THE FACTOR OF IRRITATION TO THE PERIODONTIUM BE ELIMINATED IN DENTAL RESTORATIONS?"

H. E. Friesell, Pittsburgh, Pa.: Dr. Chappelle's thesis treats principally of the clasp form of restoration. He directs attention to the facts that clasps that are too loose cause wear; if too near the gingival line, they may cause injury to the enamel, cementum and gingiva; if made too large, or not of appropriate form, they invite collections of débris; therefore, clasps should receive much greater care than is customary in general practice. Undue motion of the clasp must be limited. There must be no unnecessary contact between clasp and tooth structure or gingiva.

Because every clasp interferes with the harmonious coordination of contours of the enamel and the gingivae, thus depriving the soft tissue of normal exercise by the passing of food over it, and provides favorable rests for the collection of débris and calculus, special hygienic measures must be devised for patient and operator in clasp restorations.

The overloading of abutment teeth through failure to estimate properly the normal limits of stress resistance of the peridental membranes to vertical, lateral or torque stresses is emphasized. The fact that a failure to restore properly the occlusal contours may throw improper strain on the peridental membrane is mentioned and attention called to an important detail of our work. One readily realizes the abnormal strain on the ankle when some hard foreign body becomes attached to the sole or heel of one's shoe: the same principle applies to an inharmonious occlusal contour. An occlusal restoration of material of varying degrees of hardness, or lacking in hardness sufficient to permit uneven wear, must eventually produce a similar effect. Unlike the tissues of the ankle, which permit of considerable accommodation to an unevenly wearing shoe, the peridental membrane must suffer in proportion to the unusual direction and amount of strain thus thrown upon it.

Dr. Burgess deals principally with the theme that the gum tissues and the supporting alveolar process are living tissues; that there is a limit to the amount of stress that can be supported by the gum tissue when bridges or plates are used to restore lost teeth; that such restorations must take into consideration the normal compressibility of the gum tissue, and if the latter is overloaded, injury to the gum and underlying bone necessarily must result. He calls attention to the pathologic conditions of the soft tissues that can arise through contact with unsuitable materials in the appliances, and to the injuries to the soft tissues, and ultimately the alveolar process, by poor adaptation, and suggests as the remedy the employment of enough abutment teeth to insure no overloading of gum tissue, and the use of only proven, compatible materials and properly contoured appliances, physiologically adapted.

Dr. Maves deals largely with the theme that a correct knowledge of dental anatomy and its intelligent application is *the* matter of primary importance in any restoration, and that neglect in this regard can only result in gingival irritation, loss of contact point, drifting teeth and disease of peridental membrane and alveolar bone. He emphasizes the need for a physiologically sound foundation for any type of mechanical restoration; and recognizes that a restoration to one tooth or a few teeth cannot be limited solely to the conditions presenting in the teeth operated upon, but that the condition of all of the

teeth must be considered as well. He wants team work in his masticating apparatus, and is opposed to individual playing on the part of some members of the team. The harmonious action of every tooth in the masticating process is his ideal, and any restoration that does not produce that result is not acceptable.

He recognizes that there are wide divergencies in different mouths and that a knowledge of dental anatomy must be applied to the various conditions prevailing in the individual mouth, and that it is unwise to attempt to conform all mouths and all types of restorations to a hypothetical ideal.

Dr. Bryan deals with the fundamentals of properly restored function and shows how this is based on the sound application of a correct knowledge of the teeth and their investing tissues. He recognizes that the proper functioning and continued health of the tooth are absolutely dependent on the maintenance of a healthy peridental membrane and nonirritated gingivae; that no matter how pleasing a restoration may appear from a purely mechanical or technical standpoint, ultimate failure is unavoidable if gingival and peridental irritation are not absent. He also illustrates the importance of a harmonious relationship between the contours of the hard and the soft tooth tissues in preventing such injuries to the teeth and infers that a dental restoration that does not insure a healthful condition to the investing tissues is unjustifiable from the standpoint of acceptable dentistry.

Dr. Spalding seems to write in a pessimistic vein regarding restorations that limit to any extent the freedom of mobility of the individual tooth, and to contrast teeth thus hampered with the natural unrestored tooth, to the great disparagement of the former. We must all agree with him, I think, to the extent that sound, natural, properly functioning teeth are far superior to any restorations that we can make, and that in the main, Nature is a better dentist than most human ones. But the products of Nature succumb to disease, and restorative dentistry applied with due appreciation of the factors involved surely has its merits. No man's clothes fit like his skin; but nevertheless, we prefer clothing to shield us from the heat of summer and the cold blasts of winter—at least most of us do.

Dr. Spalding does recognize the necessity for not subjecting the peridental membrane or the gum tissue to too great a departure from their normal conditions and recognizes that Nature, good engineer that she is, provides all tissues and structures with an excess of resisting power beyond what they may reasonably be expected to endure in normal use. The judgment of the dentist in estimating this safety excess is one of the primary factors in successful restorations. When he does this correctly with fixed restorations, he should succeed just as he may do if he correctly coordinates all the factors involved in nonfixed restorations.

Dr. Davis illustrates beautifully in his essay the serious effects that may result to the whole masticating organ through the loss of one or two teeth and delay in making suitable restorations. He also emphasizes the necessity for considerinig the masticating organ as a whole in making restorations in such cases if success is to be expected.

All of the essayists recognize that no restoration can be considered solely from the standpoint of the mechanical details involved in placing the restoration on the affected tooth; that the tooth concerned is only one part of an entire organ that includes all the other teeth, their peridental membranes, gingivae, alveolar bones, etc., and that all of these tissues, their functions and limitations, must enter into the problem of restorations if the latter are to be useful rather than useless or harmful to the patient.

In this consensus of opinion, I most heartily join, believing that herein is the keystone to success in dental restorations.

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Editorial

SHALL THE SINNER BE ALLOWED TO REPENT AND REFORM?

A very nice point has been raised by one of the most worthy men in the profession, a man who represents the best element in dentistry and whose antecedents date back three generations in line of the highest type of professional gentlemen. If one were to select a man who was steeped in the essence and spirit of pure ethics, one—knowing this man—would instinctively turn at once to him. That is the type of man he is.

In line with his convictions, he writes: "In an effort to attempt to maintain the profession on the same high plane that it has enjoyed within the state of_____for years past, I am making every effort to defeat a faction within our state society whose idea is to modify the by-laws to the effect that a man who has advertised can reform for a period of years and then hope to

be admitted into the local society, which in the final analysis will mean to become a member of the American Dental Association.

"To wink at those men who would teach the ethics of the profession, and to tell the youth that their teachings are not in accord with the by-laws of the state society, and that they can advertise, reform and become a member of any association our professor of ethics belongs to, is to my mind breaking down one of the strongest pillars in our foundation."

And this argument would seem to be unanswerable. The whole tone of the letter is an expression of the most rigid observance of the fundamental principles of professional ethical conduct. It is only by an adherence to the lofty ideals of men of this character that dentistry has been maintained on the plane of its present professional status, and all honor must be accorded the many splendid men who have so ardently contended for the strictest interpretation of the letter and the spirit of our code of ethics.

But let us see—there is usually more than one side to a question, and mayhap we shall find another side to this. Would not a literal application of the ideas just advanced preclude the possibility of reform on the part of a man who had once violated the code? Would it not at least place a barrier to any incentive to reform? Carried to its ultimate conclusion, would it not foster the idea that once a sinner always a sinner? Can we as a profession afford to subscribe to that doctrine?

Have we not been taught from childhood that there is more rejoicing in heaven over the return of one lost sinner than over ninety and nine who have never strayed? We do not know all the circumstances which cause a man to sin, nor do we know all the facts which cause a man to advertise. Mayhap you and I, my brother, might have done the same thing under the same conditions. We think we would not, but how do we know? A remark made by a man who went down on the *Lusitania* should be repeated by every one of us every day of our lives. "To know

all is to forgive all." That is fundamental truth and fundamental ethics in our relationship with our fellowman. It is well for us, or is it just, to say to a man that if he has once violated the code, he is forever barred from our societies?

True, we must do all in our power to uphold the sacredness of the code, and we must do nothing to belittle it or make it appear an empty obligation. If we take into our societies a man who has once transgressed, we must be very sure that his desire to reform is sincere. We must wait long enough after his transgression to be able to judge by his daily demeanor as to the genuineness of his change of heart. In other words, he must be held to "strict accountability" for all his acts and all his utterances from the moment he essays to become a member. Our societies are not meant to whitewash wrong doing, and a man must be made to realize when he subscribes to the code that it is rock-ribbed as the law of gravity. We should be more stringent in compelling men to live up to the code after they are in a society than in keeping them out when they have expressed an earnest and honest wish to come in.

After all, let us analyze the object of a dental society. Is it not to do the greatest good to the greatest number? Shall we not recognize the fact that there are many good men outside the societies who should be in? And is it not true that we can better control the man who may be considered doubtful, and do him more good, if we have him in the society than if he is out?

Neither should we assume a "holier-than-thou" attitude toward any man: it is dangerous—more so to us than to him. No, the thing for us to do is to extend the right hand of fellowship to every earnest seeker after the light; even to the erring brother who has made mistakes and who may be groping in the dark. We may commit a blunder, we may misplace our confidence and be imposed on, but better that by far than to deny the door to one poor seeking soul and, mayhap, thereby blast a life. Let us open our arms even though all who come into them may not be worthy. We have at least opened our arms.

OUR ANNUAL MEETING

In the present issue, we are publishing the program for our meeting in October. It tells only part of the story of the preparation for the 1927 meeting. It does not tell of the activities of our President, Dr. Banzhaf, who has devoted so much of his energies during the past year to the welfare of the Association. He has traveled back and forth, east and west, north and south, across the continent, and has carried the message of the Association wherever he has gone. It does not indicate the amount of detail by our Secretary, Dr. King, in building the program for the general sessions. It does not tell of the efforts of the chairmen of the various sections in organizing their work and arranging for the section programs. On the surface, there may be little to indicate the immense amount of work performed by the Local Committee on Arrangements, but during the entire year, these men have been working continuously, with the sole idea of perfecting their plans to stage one of the greatest meetings the Association has ever held.

Everything seems propitious for a record-breaking event. The character of the speakers for our general sessions is such that our members are assured of a great treat. The leaders of thought in their respective fields in America are represented on this program, and no one need go away from the meeting without receiving the particular message he is seeking.

It is not too early to begin making plans now. Mark off the dates and arrange to go to Detroit in October.

A DAY WASTED

If a single day passes without doing some good act, some kindly service, or making some one happy, it is a day wasted. No matter how much money we may make on that day, or how many deals we may put through, or how many teeth we may fill, or how many sermons we may preach, or how many races we may win, unless there results some definite and tangible benefit which adds

CHARLES ERWIN JONES, D.D.S.
(1876-1927)

to the sum total of human happiness and well-being, we might as well record that day as lost.

Our sublimest function in life is to do good and be happy, and there are twenty-four hours in every day in which to accomplish this purpose. There are no more than twenty-four, and we cannot stretch them by any kind of subterfuge. If they are allowed to pass without worthy accomplishment, they are gone forever, and what a sinful waste it is to throw away so precious a thing as time.

We are inclined to grow careless with our days. They succeed each other in such regular order, and in such an apparently unending procession, that we assume the attitude that they will continue forever—and so they will, but not for us. Our privilege and our duty is to improve the days that are allotted to us, the limited days of our own lives, and not count the indefinite days that are to go after we are gone. Let us make the most of our days—they are our very own and they are precious.

CHARLES ERWIN JONES
(1876-1927)

Charles Erwin Jones, former registrar of the Chicago College of Dental Surgery, Dental Department of Loyola University, and former dean of the College of Dentistry of the University of Illinois, died June 21, at the Austin Hospital, Chicago, after a stroke of apoplexy which he suffered while operating on a patient in his office the previous afternoon.

Dr. Jones was born Dec. 13, 1876, at Chenoa, Ill. He received his professional training at the University of Illinois, College of Dentistry, from which he was graduated in 1900. He was identified with the Delta Sigma Delta dental fraternity, of which he was grand master, 1912-1913. He was a Master Mason and a member of both the Commandery and the Shrine. In 1918-1919, he served as president of the Chicago Dental Society. He was also a member of the Chicago Odontographic Society.

Dr. Jones is survived by his wife, who was Miss Isabelle Mackey, and by his father and two brothers. Burial services were held at Bangor, Mich., the home of Dr. Jones' father.

DEPARTMENT OF DENTAL HEALTH EDUCATION

LEGISLATION TO REGULATE DENTAL HYGIENISTS*

By HARVEY J. BURKHART, D.D.S., LL.D., Rochester, New York

UP to ten years ago, there was no legislation by any state to regulate the practice of the dental hygienist. As far as my information goes, the Legislature of the State of New York was the first to pass a law recognizing dental hygienists and defining the preliminary and professional requirements and rules for licensing them. Since that time, about twenty-eight states have passed laws to regulate their practice and have adopted many of the features of the New York statute.

There is considerable variance in the laws of the different states, due to local conditions and the sentiment of the dental profession, much as is the case with reference to laws regulating the practice of dentistry. Much difficulty has been encountered in some places because of the hostility of those interested in the connection with dental schools. In some cases, those opposed to the dental hygienist have endeavored to have clauses inserted in the law for the purpose of discrediting it and also to destroy its usefulness. It is only fair to say that, in most sections, opposition to legalizing the practice of the dental hygienist is due, for the most part, to the fear that she will engage in the practice of dentistry, and by so doing overstep the line and become a competitor to the regular dentist. My experience over a period of ten years convinces me that this fear is not well founded.

In my opinion, the essential things to be considered in the formulation of any law to regulate the practice of the dental hygienist is (1) proper preliminary requirements; (2) a proper curriculum for teaching in institutions under the supervision of competent authorities; (3) an adequate licensing examination that will determine their fitness to practice; (4) annual registration; (5) plain and proper definition of the scope of practice; (6) stringent regulations not only to punish dental hygienists for violating the provisions of the law, but also to revoke the license of the dentist who knowingly aids and abets the hygienist in illegal practice or evasion of the law.

The dental hygienist law enacted by the Legislature of the State of New York in 1916 provides that (1) all applicants for admission to a school for dental hygienists must have as an entrance requirement, four years of high school or its equivalent; (2) they must be

*Read before the Section on Dental Legislation at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 26, 1926.

in attendance one academic year in a school registered by the regents as maintaining a proper standard and equipment, and legally incorporated and established in connection with a dental dispensary or infirmary for women students; (3) before being admitted to the licensing examination, a candidate must submit evidence that she is more than 19 years of age, is of good moral character and has complied with and fulfilled the preliminary and professional requirements, and the requirements of the statute; (4) after satisfactorily passing their licensing examinations, they shall be registered and licensed to practice as dental hygienists by the regents, under such rules as the regents shall prescribe. These rules are as follows:

Any licensed dentist, public institution or school authorities may employ such licensed and registered dental hygienist. Such dental hygienists may remove lime deposits, accretions and stains from the exposed surfaces of the teeth, but shall not perform any other operation on the teeth or tissues of the mouth. They may operate in the office of any licensed dentist, or in any public institution or in the schools under the general direction or supervision of a licensed dentist, but nothing herein shall be construed as authorizing any dental hygienist performing any operation in the mouth without supervision. The regents may revoke the license of any licensed dentist who shall permit any dental hygienist operating under his supervision to perform any operation other than that permitted under the provisions of this section, and they may also revoke the license of any dental hygienist violating the provisions of this act.

For the past ten years, I have had abundant opportunity to observe the working of this law, not only in the State of New York, but also in other states, and I am convinced that wherever it has had a fair trial, there has been no reasonable or just cause for complaint. Without any pride of opinion with reference to this matter, it is my firm belief that the law and regulations referred to will safeguard to the fullest extent the interests of the public and of the dental profession.

DISCUSSION

Hugh G. Tanzey, Kansas City, Mo.: While I may not be familiar with the correct definition of the term, in my opinion a dental hygienist should be a superdentist rather than a subdentist. I see no reason for a state law referring to a dental hygienist as "she." As far as I am able to ascertain only two reasons have been advanced in support of the employment of dental hygienists: one, in order to advance the interest of dentistry by educational process, or propaganda, in plain words; the other, in similar terms, to provide a means whereby a dentist can escape the drudgery in connection with thorough dental prophylaxis, and at the same time increase the financial returns incident to a practice in general dentistry. If we are to uphold the traditions and ideals of the pioneers who were dominating influences in their respective localities a quarter to a half century ago, we should advocate the raising of the standard of excellence among our dental educators. If we are going to enter this field of education through public school, radio, newspaper or other sources, we should do so with teachers and demonstrators possessing the degree of doctor of dental surgery or its equivalent. A competent dental hygienist should have special training or postgraduate experience in addition to the regular courses provided by dental colleges at the present time. I have arrived at this conclusion after twenty-five years of experience, twenty years of which has been devoted almost exclusively to the practice of orthodontia, which has provided ample opportunities for the observation of the teeth in the care of scores of dentists. Students of dentistry, young dentists and experienced dentists alike, should be informed of the possibilities of skilled work in this field as among the most alluring inducements held out in any branch of the medical arena. As in other specialties, it is only by perseverance, the most exacting discipline and the possession of certain inherent qualities, that one arrives at this high order of skill. Why should this basic principle of all dental health

be considered beneath the dignity of the hosts who have selected it rather than having been called? The necessity for "teeth cleaning" of the type effected by many hygienists and, I might add, by sundry dentists, is largely speculative and overdrawn. The removal of "lime deposits, accretions and stains from the exposed surfaces of the teeth" of school children under 7 years of age is rarely urgent. Exceptional cases would, in all probability, be accompanied by pathologic conditions which the hygienists, through lack of knowledge and experience, would not recognize. If the remuneration is to be considered, parents of young dentists who have been educated after great sacrifices have been made, and financial resources often strained, should make a last stand for the recognition of dentists' rights. Dr. Burkhart refers to "the hostility of those interested in and connected with dental schools." Since it is within the province of dental schools to give instruction in all subjects allied with dental significance, I would presume that the possibility of objections from that source was remote. I think dentists should see what is happening to the medical profession and stand solid against legislation which will inevitably result in lowered standards for our profession.

THE DENTAL EDUCATIONAL CAMPAIGN IN THE DISTRICT OF COLUMBIA

By C. WILLARD CAMALIER,† D.D.S., Washington, D. C.

THE ability to visualize the future is probably the greatest asset to a committee planning a dental health educational campaign. In other words, a committee which attempts to promote such a campaign is marked for failure in the beginning if it does not prepare its objectives and work energetically toward them.

The personnel of the committee is very important, and it is necessary that the members be selected with reference (1) to their ability and desire to work; (2) to their position in the official life of the community, and (3) to their partiality toward the dental health educational idea. With these ideas in mind, the following persons were invited to become members of the local committee: Drs. Allan Scott Wolfe, E. R. Stone, B. E. Erikson, G. G. Frazier, D. H. Miller, Joseph A. Murphy, chief medical inspector of public schools, Clinton T. Messner, U. S. Public Health Service, and Mrs. Ernest R. Grant, of the Association for the Prevention of Tuberculosis, Com. Marion E. Harrison, U. S. Navy, and Lieut. Col. Rex H. Rhodes, U. S. Army.

Through this committee, it was possible to make certain contacts necessary to insure the success of the campaign; namely, the public school system, the Public Health Service, the Army, the Navy, and the Association for the Prevention of Tuberculosis. It was thought later that a prominent member of the District of Columbia Parent-Teacher Organization might have been added to advantage, and this will probably be done in subsequent campaigns. A committee composed entirely of dentists could not be so generally successful in its efforts.

†Chairman, Committee on Oral Hygiene and Public Instruction of the District of Columbia Dental Society.

The committee formally organized and was promptly divided into subcommittees to handle the various lines of endeavor. It was decided, almost immediately, to eliminate the thought of a dental health week, with the idea, first, that speciality weeks of all kinds have been severely criticized in the past few years, and secondly, because it is impracticable to accomplish anything of consequence in seven days. It was, therefore, decided to call the campaign a "Dental Health Educational Campaign" to run, April 4-23, 1927, approximately three weeks. The committee felt also that its efforts would be dignified to a greater extent if it kept away from the "specialty week" idea, which has been appropriated by every type of organization, with such titles as "Clean Up," "Paint Up," "Fire Prevention," "Be Kind to Animals," etc. The action would also obviate bringing the dental society's efforts within the scope of the criticism of the press. It was later found that our forethought in this respect worked out admirably. In order to set at rest the minds of those persons who might be inclined to feel that the campaign was an advertising proposition, the committee decided to call the attention of the public to two points; namely, that the dental society heartily indorsed additional free clinics in the public schools, and that the campaign would stress preventive measures only.

The committee was fortunate in securing the following indorsements from the Surgeons General of the Army, the Navy and the Public Health Service.

It has come to my attention that the District of Columbia Dental Society will project its second annual dental health campaign beginning April 4, 1927. Such projects conducted throughout the United States will do much towards promoting health and I wish to indorse heartily the activities of your Society in this field.

Very truly yours,

M. W. IRELAND,
Major General
The Surgeon General, U.S.A.

I am very glad to know that the District of Columbia Dental Society plans a second annual dental health campaign beginning April 4, 1927.

The dental health project undoubtedly is one of the most important health movements of modern times. It has my hearty endorsement.

The Bureau of Medicine and Surgery is very much interested in dental professional progress and we are particularly interested in the development of close cooperation between our dental and medical officers.

The knowledge that many advances in the affairs of the Naval Dental Corps and in our oral health service have taken place during my terms of office is very gratifying.

Cordially yours,

E. R. STITT,
Surgeon General, U. S. Navy.

Reference is made to your letter of November 24 advising that the week beginning April 4 has been selected for the second annual dental health campaign.

The District of Columbia Dental Society is to be commended for its progressiveness in bringing before the people of the community the importance of keeping the teeth and mouth in a clean, healthy condition. There is perhaps no better nor surer method by which we could insure the health of a community than by bringing before the public the necessity of personal hygiene. Such a movement, enlarged and carried nationwide, would, I am sure, result in better health for the people of every community.

Respectfully,

H. S. CUMMING,
Surgeon General, U.S. Public Health Service.

It seems that these indorsements should be a stimulus to dental educational campaigns throughout the country, and in this connection, it is quite appropriate to quote below a portion of

the speech of Wendell C. Phillips, president of the American Medical Association, at the recent session of the Association held in this city, which is self-explanatory and shows the interest manifest by the medical profession in the comparatively new idea of educating the public along health lines.

The medical profession should throw off its mask of reticence and its shrinking attitude toward reasonable publicity concerning health education. Professional policies narrowly conceived can never successfully oppose the rightful interests of the public. It is time to strike the shackles not only from the shrinking attitude of the medical profession toward the public espousal of educational programs, but also from its attitude toward the lay press, the radio and great assemblies of truth-seeking persons. The physician has no right to conceal from the great body of nonmedical readers the great body of news of the highest importance which is his to communicate.

The following program involving the public schools was submitted to the superintendent of schools and received his approval:

1. The sending of letters to the principles of the senior and junior high schools, requesting permission to have a paper on oral hygiene read to the pupils by a representative of the dental society; this paper not to take more than ten minutes for delivery.

2. The sending of a letter to each teacher in the graded schools and junior high schools, setting forth the aims of the dental health program, outlining proper methods for the care of the teeth, and transmitting therewith copies of the official programs of the dental society.

It is proposed that this program be given to each child with instructions that it be taken home and posted in a convenient place. These programs will have at the bottom coupons which may be clipped by the parent and used to gain admission to the educational exhibits and moving pictures to be furnished by the dental society and shown at the National Museum, April 19, 20 and 21, 1927.

3. The discussion by teachers of the subject of oral hygiene with their classes, and, if it can be conveniently done, the drawing of posters with reference to oral hygiene by the class.

Prizes will be offered for the best posters submitted on the care of the mouth. These will be, $10 for the first, $5 for the second, $3 for the third and $1 each for fifteen of the next best.

4. A request to teachers that all pupils be advised that the District of Columbia Dental Society offers prizes for the best slogans to be used during the dental health campaign, these slogans to consist of a snappy sentence of not more than eight words, and to be handed to the teacher not later than April 2, 1927, and similar money prizes to be offered in the slogan contest to those offered for the best posters.

Teachers will not be requested to grade the posters or to pass judgment on the slogans. This work will be done by the dental society.

It is the intention to display the best posters and slogans submitted at the exhibit as specimens of work done by school children. Public awards will be made of the prizes.

5. The Society also has tentative plans to request such junior high and grammar schools as may desire it to present dental plays and receive probably a loving cup for the best projection. This plan will only be consummated if the principals of the schools desire to enter the dramatic classes in the competition.

6. The dental society has already presented to the director of visual instruction a number of films on oral hygiene, which it is hoped may be used in conjunction with the dental health campaign.

With respect to the moving pictures, the committee secured from the American Dental Association, Department of Dental Health Education, the films "Your Mouth," and "Clara Cleans Her Teeth;" from the S. S. White Dental Manufacturing Company, "Don't Wait 'Till It Hurts," and from the U. S. Public Health Service, "Tommy Tucker's Tooth," which were placed in the visual instruction classes of the schools and shown to approximately 14,000 children. These pictures were found to be educational and interesting, and undoubtedly accomplished a great deal of good in developing the idea of better care of the teeth among the school children and their parents.

The accompanying "Program of Dental Health" was prepared after a great deal of consideration. Eighty thousand of these programs were printed and the teachers were requested to give one to each child, to be taken home and signed by the parent, the coupons to be clipped, and the remainder of the card posted in a conspicuous place in the home. This served as a constant reminder to the child, and incidentally to the adults, of the necessity for the daily care of the mouth, and advised concerning the types of foods necessary for the building of strong teeth. The coupons at the bottom of the card were, as will be seen, invitations to the children and parents to attend dental exhibits and motion pictures, April 19-21, at the National Museum. It was subsequently found that thousands of these coupons were brought to the National Museum by the children and parents.

A wonderful result was obtained through the offering of prizes for posters and slogans. Approximately 500 posters and 400 slogans were sub-

O

READ Hang Up PRESERVE

District of Columbia Dental Society

Program of Dental Health
For the Mother

BUILD SOUND TOOTH STRUCTURE BY PROPER DIET AND DAILY SUNSHINE EXPOSURE FOR

(a) Expectant and nursing mothers,
(b) Infants and developing children.

Good teeth require minerals, salts and vitamins. These are found in the following foods:

Milk Fruits
Coarse whole cereals including whole wheat or graham bread.
Vegetables, especially leafy ones.

For Children and Adults

PRESERVE THE TEETH BY

(a) The use of foods which exercise the teeth and jaws. Finish meals with type of food tending to cleanse the mouth, fruits and leafy vegetable salads being desirable for this purpose.
(b) Frequent daily brushing. Use a small, medium stiff brush. BRUSH TEETH AND GUMS at least two minutes, after meals, especially following breakfast and before retiring. Brush down on the upper jaw and up on the lower.
(c) Having small cavities filled early, before they become large, and examination by a dentist every six months beginning at three years of age.

CARE OF THE BRUSH

After using, rinse well in hot water. Sprinkle or dip in table salt and hang in clean, dry place where sunlight enters occasionally.

IMPORTANT

The responsibility for the child carrying out these instructions rests primarily on the parent or guardian. "An ounce of prevention is worth a pound of cure."

BETTER TEETH—BETTER HEALTH

(Clip here)

This coupon admits children and parents to FREE motion pictures and exhibits at the National Museum, 10th and B Streets, N. W.; from 9 to 5 P. M., April 19, 20 and 21st, 1927.

(Clip and Return to Teacher)

I will accept the invitation of the D. C. Dental Society to attend its educational exhibits.

Name .....

School .....Grade .....

.....
Parent or Guardian

Fig. 1.—Program of dental health.

mitted by the children of the public and private schools, and these were placed on exhibition in the corridors of the National Museum during the three days mentioned above. The consensus of opinion of the dentists who saw them, and of members of the art groups, was that the work and the exhibition thereof was of the highest order. The slogans were ingenious and some might be used, with modification perhaps, in dental educational campaigns in other sections of the country. The committee is especially desirous of bringing to the attention of dental health committees the value of the poster and slogan contests;

Fig. 2.—Dramatic class, Parkview Platoon School, winner in dental play contest. The scenery was made by the art teachers at the school.

for in addition to the interest created and the educational value obtained, something concrete is available to show for the effort expended.

Another feature of the campaign which was found to be of immeasurable value was the staging of the play contest. At the beginning, the committee

Fig. 3.—Exhibit of public health service, dental hygienists' association and Baltimore College of Dental Surgery, University of Maryland.

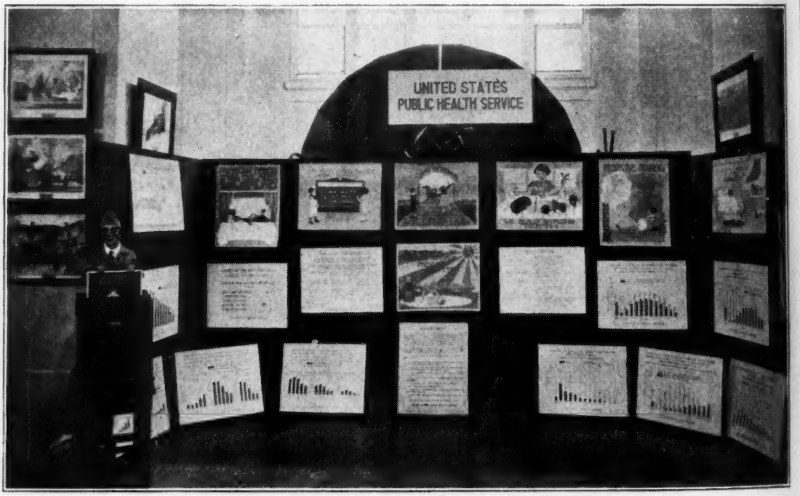


Fig. 4.—Exhibit of United States Public Health Service, dental section.

was rather skeptical with reference to the interest which might be displayed in this phase of the program, but was amazed to see how these doubts were eliminated immediately the plan was projected. Without special effort, the committee interested the dramatic teachers of three junior high schools and two elementary schools and gave them the sketch "The Bad Baby

Fig. 5.—Exhibits of Children's Bureau; American Red Cross and United States Navy and Army.

Fig. 6.—Exhibit of the Baltimore College of Dental Surgery, University of Maryland. The dentures worn by George Washington are on a cabinet in a glass case.

Molar," copies of which may be obtained from the American Dental Association. The instructions permitted the schools to use these plays as a basis and modify them as they saw fit. The result was the production of the play substantially as it is written, with special features to induce the judges to give the school producing it the prize, a silver loving cup, suitably engraved. A fortunate feature of the contest was that the judges were unable to decide between two schools, and it was necessary for the two casts to restage their plays one after the other on the same platform. This latter contest, particularly, created a great deal of enthusiasm, and the large auditorium of the McFarland Junior High School was crowded to its doors. These play contests were shown to approximately 6,000 children and adults. The press took particular notice of the contests and published not only the names of the children but pictures of each individual cast. Through the interest of Colgate and Company, the Prophylactic Tooth Brush Company of Florence, Mass., forwarded to the committee a 4-foot toothbrush, which was used to advantage in the play contests.

With the permission of the principal at the Wilson Normal School, and the board of education, hundreds of pupils participated in a sketch, which was filmed by the International News Service. The large toothbrush referred to was shown prominently in action depicting very vividly the art of thoroughly brushing the teeth. This film was syndicated throughout the country and probably has been seen by many of the readers of this article.

A poster headed "Better Teeth—Better Health," describing the method of brushing the teeth, and the kinds of foods to be eaten to build strong teeth, was displayed in all Sanitary Grocery Stores, People's and Liggetts Drug Stores, and other prominent establishments throughout the city. The street cars carried posters calling attention to the dental educational campaign and inviting the public to the exhibits and motion pictures at the National Museum. This invitation was also included on the posters displayed in the store windows.

A letter was sent by the committee to all civic organizations in the city, outlining the aims of the dental educational campaign and offering to furnish speakers either during the campaign or at any other time more suitable to the organization. We were met by a most generous response, and it was with difficulty that sufficient dentists were induced to take the assignments. However, every request was complied with and the interest manifested was remarkable.

Sets of speeches appropriate for various civic organizations and school groups were purchased from the American Dental Association, Department of Dental Health, and used by our men as a basis for their talks before the various organizations. Each speaker was requested to lay stress on the exhibits and motion pictures which were to be shown at the National Museum. It can be confidently estimated that the speakers addressed 6,000 members of parent-teacher organizations and other civic groups, and when it is remembered how

little interest is usually taken in health talks, this result is considered quite satisfactory.

The Association for the Prevention of Tuberculosis became vitally interested in the dental health educational campaign and inserted paid advertisements in the daily press, covering various phases thereof, and in other ways gave material aid.

With reference to the demonstration at the National Museum, through the kindness of Dr. Alexander Wetmore, assistant secretary of the Smithsonian institution, the large auditorium of the National Museum and one-half of the immense corridor leading thereto was granted the committee for the showing of motion pictures and the installation of its exhibits. Three of the motion pictures mentioned were shown in the auditorium, April 19-21, from 9 to 5 o'clock and were visited by not less than 6,000 children and adults. In the corridors were displayed oral hygiene exhibits of the District of Columbia Dental Society, the public schools, the U. S. Public Health Service, the U. S. Army, the U. S. Navy, the American Red Cross, the Children's Bureau, Department of Labor, the dental hygienists' association and the Baltimore College of Dental Surgery, University of Maryland. Each exhibit was carefully planned to be of interest to both children and adults, and according to official figures of the National Museum, approximately 21,000 people passed through the exhibits. The walls of the corridors adjacent to the auditorium were covered by the posters and slogans submitted by the school children and, as stated before, afforded a most impressive spectacle. The winning posters and slogans were hung together and in order according to their rank. For the entire three days, the local dental hygienists' association had its members clean the teeth of children desiring it and gave lectures and demonstrations on the better care of the mouth and the best kinds of food. This demonstration alone drew enormous crowds and accomplished much good.

The committee was exceedingly pleased at the favorable expressions of officials at the National Museum, who suggested that the exhibits be permitted to remain for a longer period.

The climax to the campaign was the great meeting in the auditorium of the National Museum on the evening of April 19, which was addressed by Willis A. Sutton, superintendent of schools of Atlanta, Ga., on the subject "Prolonging Life and Saving Millions by Oral Hygiene." This splendid address should be heard by every dental society and group of school officials and parent-teachers organizations in the country. Dr. Sutton puts the health of the child where it belongs, namely, above scholastic training, and he criticizes the professional man and layman who fails to further the cause of health education. "The Bad Baby Molar" was reproduced at this meeting by the winning cast in the play contest who were generously applauded by the audience for their efforts. Frank W. Ballou, superintendent of schools, awarded the prizes in the poster, slogan and play contests, and a splendid effect was produced by having the winners in these contests on

the stage with their posters and slogans, on which a strong searchlight was turned. Among the officials who occupied seats on the platform were Proctor L. Dougherty, president, Board of Commissioners of the District of Columbia, Harvey W. Wiley, food expert, William C. Fowler, health officer, Joseph A. Murphy, chief medical inspector of public schools, Mrs. Giles S. Rafter, president, D. C. Parent-Teacher Association, Mrs. Joseph N. Saunders, vice president of that organization, S. E. Kramer, assistant superintendent of the schools, and Mrs. Ernest R. Grant of the Association for the Prevention of Tuberculosis.

The reaction to the campaign has been increased interest in dental education, better care of the teeth by children and adults, including regular visits to the dentist, and an appreciation by the public and public officials of the dental society and the profession in general for the interest shown in public health from the dental angle.

As a followup to the dental educational campaign, the committee actively participated in the plans of the May Day Committee for the District of Columbia. At the request of this committee, dentists were assigned to all child welfare stations in the District to examine the children for dental defects.

The following are two examples of many letters received which indicates somewhat the appreciation of the public when a dental society really does something in a public spirited attitude.

Last Thursday, I had the pleasure of visiting the oral hygiene exhibits shown in connection with the dental campaign of the District of Columbia Dental Society, and I feel that the society is to be congratulated on the splendid spirit which prompted so extensive and thorough a campaign in the interest of public health.

I noted the keen interest manifested by the public who visited the exhibits, as well as the evident interest the school children of the District of Columbia have taken in the work. Such a public spirited campaign must inevitably help toward a higher standard of health in this community.

If at some time in the future it is convenient for you to send me an outline of the program which you followed in carrying out your campaign, I would greatly appreciate receiving it.

Yours very truly,

C. C. PIERCE, Acting Surgeon General,
U. S. Public Health Service.

I would call to your attention resolutions passed unanimously by the District of Columbia Congress of Parent-Teacher Associations at its regular annual state convention, April 27, 1927, a copy of which is enclosed herewith.

Very cordially yours,

BERTHA GRAY BYLER,
Corresponding Secretary.

Resolved, that the District of Columbia Congress of Parent-Teacher Associations express to the District of Columbia Dental Society its appreciation and thanks for the splendid campaign recently carried on by that society looking toward a more adequate care of the teeth of our children.

The Committee, in closing, desires to express its deep appreciation to Miss Evelyn C. Schmidt, director of the Department of Dental Health Education of the American Dental Association, for her prompt response to the many demands made on that department for information and material. Unquestionably, the Department of Dental Health Education was wisely created and it seems indispensable to the proper furtherance of these campaigns throughout the country.

REPORT OF FORSYTH DENTAL INFIRMARY FOR CHILDREN*

By HAROLD DeW. CROSS, D.M.D., F.A.C.D., Boston, Massachusetts

THE Forsyth Dental Infirmary for Children was founded by John Hamilton and Thomas Alexander Forsyth in memory of their brothers James Bennett and George Henry Forsyth, and was incorporated in 1910 by a special act of the Massachusetts Legislature, for the purpose of establishing and maintaining an infirmary for the reception and oral treatment, dental, medical and surgical, of children under the age of 16 years, and of such other persons as the corporation might from time to time determine. It was dedicated in November, 1914, and the clinics were opened soon after, and were in full operation in January, 1915, so that it has now been in operation more than eleven years.

In formulating a working policy for its development, the Trustees decided at the outset that, to accomplish the greatest good, the new institution must aim at something higher than the mere repair, treatment and extraction of carious teeth, the correction of oral deformities or the removal of diseased tonsils and adenoids. It was recognized that the prevention of disease was as important as, if not more important than, its treatment, and it was further thought that the clinical work of the institution should be developed on a plane of technical perfection sufficiently high that it should stand in the same relation to the dental profession that the hospital bears to the medical profession.

Without going into these subjects at tedious length, it was believed that, conducted on the plan indicated, the institution would be of inestimable hygienic value to the rising generation of the children of Boston, and its vicinity; that it would instruct them, not only in dental hygiene but in general hygiene as well; that it would improve their nutrition, and consequently their physical and mental growth; that it would lessen their liability to contract contagious and other diseases, and would place them in a better position to resist disease if contracted.

In order to obtain a suitable understanding of the type of work carried out in the Forsyth clinics, it is necessary to know that prevention is the factor first considered, rather than the cure or repair of established conditions. It was the original intention of the trustees to carry out, as fully as possible, all clinical factors of a preventive nature dealing with tooth diseases, and this has been done to as great an extent as the present status of knowledge has permitted. Older practices have been given up and new ones adopted as rapidly as some procedure has been found to have a larger proportion of features of prevention. Prevention is here used in the sense of real avoidance of a condition or occurrence, as it is in medicine, and not with the usual dental meaning of merely an improvement in

*Read before the Section on Mouth Hygiene, Preventive Dentistry and Public Health at the Seventh International Dental Congress, Philadelphia, Pa., Aug. 26, 1926.

an already established technic or procedure. Consequently, the present practice does not include the devitalization of pulps, the treatment of root canals, or the insertion of extensive fillings in the attempted restoration of badly broken down and neglected teeth, but rather involves the early treatment of developmental defects and incipient cavities, either by dental procedure or by nutritional improvement in a medical or systemic sense.

The usual and more complicated dental technic is discarded for a simple type which is all that is needed in caring for the early and simple tooth defects. The lack of complicated technic and the care of extensively and badly broken down teeth has frequently been remarked on to the exclusion of the continued maintenance of good tooth conditions and the avoidance of defects.

In order to accomplish results that are at all preventive in character, it is not only necessary to carry out certain simple technical procedures, but the case must be in a suitable condition to make these procedures possible, as well. This involves chiefly the opportunity to treat the cases before conditions have developed beyond a very early stage, and consequently the age of the child is of as much importance as are the clinical procedures. In other words, it is necessary to have both the technic and the time of applying it correlated, in order to obtain the definite advantages that are possible.

As the first permanent molar is responsible for a greater amount of trouble than any other one tooth, it becomes necessary to consider the age of its eruption as marking the latest time when treatment may be considered prophylactic in character, although, for the succeeding permanent teeth, the eruption time may be similarly considered. While the age of 6 years may thus be indicated as the maximum age, there is no definite limitation to the earliest, and there may be some question as to whether we should consider it to be the age of eruption of the primary teeth—early infancy—birth, or the prenatal period, or should go back to the grandparents.

The greatest difficulty has been, and is still found, in getting parents, nurses, physicians and dentists to appreciate the importance of early attention, so that, in any community, the age question is still more of a problem than that of clinical procedures which have been well standardized and put to a successful test. However, this plan of early (6 years of age) treatment has been carried out to the extent of approximately 75 per cent for the last four or five years, but a definite advance has been made during the last year, when practically every new patient has not been more than 6 years of age. This has made it possible practically to eliminate all root canal work, as teeth that are carefully filled when the cavities are of a simple character do not come to the condition of requiring large fillings, pulp and root canal work, until late in life, if at all.

With this preliminary explanation as to the general policy of the clinic, it will not be necessary to explain in detail for each clinic the reasons for certain procedures or technic, as these will be the same in each instance. Not only is substitution made for complicated treatment, which results in bringing prevention nearer, but also medical and dental procedures are adopted, such as nutrition, and endocrine or maxillary orthopedic treatment, rather than the elaborate and repeated fillings and

treatment in cases of excessive caries or narrow and undeveloped arches.

The clinics are carried on under the following departments and clinics:

1. Dental: Filling, cleaning and extracting; maxillary orthopedics.
2. Medical: Pediatric, nutrition, food and habits, and endocrine.
3. Surgical: Tonsil and adenoid, and oral surgery.
4. Research: (a) Laboratory—bacteriologic; chemical; feeding; (b) clinical—observing, recording and correlating clinical data.
5. Statistical: For recording and filing records of all clinical work of all departments and clinics.
6. Prenatal: Treatment in dental, endocrine and food and habit clinics.
7. Roentgen Ray and Photography: For all departments; principally for medical and maxillary orthopedic clinics.
8. Social Service and Registration: For registration and admittance to all departments; the principal feature being to determine the financial eligibility.

The clinical dental work is done by full time interns who are current-year graduates of the various dental schools, and are supervised by a full-time permanent chief and two assistants.

The medical and surgical clinical work is done by medical men on service, three months at a time.

The dental cleaning (odontexesis) is done by the students of the training school, under direction of a graduate supervisor.

All patients, except in emergency cases, first have the necessary cleaning, filling and extracting done, and are then given routine examinations for the medical and surgical work which is shown to be necessary, such as the removal of diseased tonsils or treatment in the nutrition, food and habit, endocrine or maxillary orthopedic clinics.

All of the clinics are definitely correlated and conducted as one with several branches, and are coordinated to the extent that, as routine, each child who enters for whatever particular type of treatment (except for emergencies) is required to go through all of the clinical examinations. In this way, all necessary data pertaining to an individual child are obtained and correlated, independently of either the patient or the physician in some clinic whose casual notice may detect necessary work to be done in another one.

Patients showing such evidence of malnutrition as approximal or cervical caries, underweight, endocrine dystrophies, or generally poor physical condition, are referred for a physical examination and then recommended to the suitable medical or surgical clinic for treatment.

All medical treatment, including food and habit regulation, is preceded, in every instance, by a complete physical examination so that the exact condition of each child is known, in order not to carry out any treatment which might be contraindicated.

The primary teeth of a large number of children from 2 to 3 years of age are treated for pits and fissures. It is the aim to fill all cavities within six weeks after eruption, whether in primary or secondary teeth. It is not yet possible to do this for the primary teeth to the same extent as for the secondary, because of the difficulty of getting in touch with children of this age. Through infant hygiene and preschool age children's associations, a definite gain is being made each year and large

numbers of this age are now treated. More time probably will be required to place the treatment of primary teeth on a par, in numbers, with that of the first permanent molars, than was required for secondary teeth, but it will undoubtedly be accomplished within a few years.

The results obtained by the early filling of fissures and pits within a short time after eruption of the teeth has prompted the adoption of a plan to see children only at stated intervals for routine fillings. These intervals are not determined by the calendar, age or school grade, but according to the eruption of each corresponding pair of teeth, and are sufficiently frequent to forestall any possible rapid extension of a developmental defect. To make the work successful, it is necessary that this period be very short, and the nurses are instructed that within "six weeks" is the only safe time. In this way, detailed school examinations become unnecessary, as all that is required is for the nurse to keep watch for new teeth, of which the child is usually aware, and see that all new teeth receive prophylactic care and fissure and pit fillings, if required.

In general, the routine ages at which we may expect to find erupting pairs of teeth are 2, 6, 9 and 12 years respectively, varying in each instance according to the physiologic age and development of the child. Thus, only three regular periods of visits for fillings are needed during the school life of the child.

Each child receives an odontexesis (tooth cleaning) once each year, at which time special appointments are made if any fillings require replacement, or any new (approximal or cervical) cavities are noted. The number of such cavities is quite small, except in cases of malnourished children suffering from a serious lack of lime salts, or with endocrine complications. In these instances, the child not only has the fillings done, but is given appropriate medical attention from a nutritional standpoint, such as endocrine, food and habits, etc.

In a recent checkup, it was found that 82 per cent of the children in the eighth and ninth grades who had not been given adequate early care, but who had received treatment either as first, second or third grade pupils, had four first permanent molars in good condition; 11 per cent had three first permanent molars, and these and the balance were those in whom these teeth were rather early in erupting, or who did not receive treatment until the end of the third school year.

While most of the cases not treated until the third grade showed large occlusal fillings in the first molars, these teeth were still being preserved, although undoubtedly many will require attention, possibly involving treatment of the pulp and root canals, in the near future. Those treated early in the first grade show only small fissure fillings and will not require attention for many years. Even then, they will only reach the stage of requiring small occlusal fillings.

Another phase of the benefits of early treatment was as follows: In 1915, one first permanent molar was extracted to every three teeth. This was gradually reduced, in 1918, by early attention, to one first permanent molar to every five teeth, and, in 1924, only one first permanent molar in each 200 teeth extracted, in the groups which received reasonably early care after the time of eruption of the first permanent

molars. From 1915 to 1918, at least 50 per cent of the first permanent molars were given root canal treatment; while, since then, this form of treatment has been practically discarded. This means that the only first permanent molars which require extraction now are those in the mouths of children who, for one reason or another, did not receive sufficiently early care for developmental defects.

The foregoing Forsyth plan, while extremely simple and nontechnical in character, is giving "end-results" at 16 years of age, in healthy teeth which have had the minimum of dentistry, as early repair work; and four first permanent molars with vital pulps and small fillings are the satisfactory results. This is a result which technical (orthodox) dentistry has never produced and never can, because it does not aim to prevent, but to cure and repair.

While the original intention was to care for children up to the sixteenth year, and this was necessary when "orthodox" dentistry was practiced, it has been found that there is now no dental reason for continuing this care for children beyond the twelfth year, or the time that the second permanent molars are in place and the fissures and pits filled. The only exception is for children with marked malnutrition; but with the Forsyth plan, these cases usually have been brought up to the standard of nutrition before the twelfth year, so that, in the next few years, there should not be much occasion for repair or replacement of fillings.

The work done under the name of maxillary orthopedics is another phase of early treatment which is giving very satisfactory results in preventing the need of orthodontic treatment. This work consists in expanding the maxillary bones at the usual age (5-6 years) when this growth usually takes place, in cases which, through lack of suitable growth stimuli, fail to develop.

The tooth positions are not changed, as the teeth merely provide attachments for the appliance that expands the arch of the maxillary bones; which assures ample room for the eruption and alinement of the six permanent teeth.

A prenatal clinic is carried on to aid in preserving the mother's teeth and in developing good dental organs for the child by oversight and treatment in the medical, dental, endocrine and food and habits clinics. This work is being carried out for prospective mothers, in cooperation with several of the prenatal organizations of the city, and is as near early treatment and prevention as we may expect to get, although, as our knowledge increases, it should be possible to apply it with more certain results.

One important phase of this clinic is the maintenance, in the mother, of a state of nontoxicity; the regulation of her food and other habits for adequate mineral and vitamin metabolism, and assurance to the endocrine organs of any support needed to enable her to give to the child's teeth every possible advantage of development.

It is, of course, too soon to be able to determine the results of the prenatal dental care phase, or to attempt to draw conclusions from either the effect of the endocrine or food and habits treatment and supervision.

It is reasonable to expect conservation of the mother's teeth and an improvement in the dental organs of the child from these various activities if, as is almost assured, they result in improved nutrition, from the standpoint of mineral metabolism.

AMERICAN DENTAL ASSOCIATION SIXTY-NINTH ANNUAL SESSION

DETROIT, MICHIGAN, OCTOBER 24, 25, 26, 27, 28, 1927

OFFICIAL CALL

To the Officers, Members and Constituent Societies of the American Dental Association:

You are hereby notified that the Sixty-Ninth Annual Session of the American Dental Association will be held at Detroit, Mich., Oct. 24-28, 1927.

The House of Delegates will convene at 10:00 o'clock in the forenoon and 2:30 o'clock in the afternoon, Monday, October 24, in the Book-Cadillac Hotel. The third and fourth meetings of the House of Delegates will be held Wednesday and Thursday, October 26 and 27, at 2:30 o'clock in the same hotel. The Credentials Committee will register delegates and alternates, beginning 9 a. m., Monday, at the Book-Cadillac Hotel. All other members must register at the Registration Office in the General Motors Building.

The general meeting, which constitutes the opening exercises of the Session, will be held Tuesday, October 25, at 9:40 a. m., in the Auditorium of the General Motors Building, and general meetings will be held at 8:00 p. m. on that and subsequent days of the Session in the Ballroom of the Book-Cadillac Hotel.

The various sections, general clinics, section clinics, dental health exhibit, scientific exhibit, motion picture program and technical exhibits will be held in the General Motors Building, according to their respective programs.

The Registration Department will be open from 8:30 a. m. until 5:00 p. m., Monday, Tuesday, Wednesday, Thursday and Friday, October 24, 25, 26, 27 and 28, in the General Motors Building.

The constituent societies are hereby notified to file with the General Secretary of this Association, at least thirty (30) days prior to the first day of said Annual Session, a list of the names and addresses of their delegates and alternates.

HENRY L. BANZHAF, *President.*
OTTO U. KING, *General Secretary.*

SPECIAL ANNOUNCEMENTS

To the Officers, Committees, Commissions, Board of Trustees and Delegates to the Sixty-Ninth Annual Session of the American Dental Association:

I desire to call your particular attention to the following standing resolutions:

BUDGET

Resolved: That all committees and commissions of this Association requesting funds for carrying on the work of this Association must present their financial requirements for the ensuing year to the Board of Trustees sufficiently in advance of the Annual Session of this Association that these requests may receive careful consideration by the Board of Trustees for the preparation of a budget. This budget shall be printed and presented to the House of Delegates for their approval and shall be acted on at a subsequent meeting. (Transactions, 1925, p. 154.)

RESOLUTIONS ADOPTED BY TRUSTEES

Resolved: That all committees, commissions or other activities connected with this Association be required to make a detailed statement to the Board of Trustees of the source of all receipts of funds, materials, etc., from any and all sources.

Resolved: That all committees, commissions or other activities of the Association receiving appropriations of funds of any nature make a detailed statement to the Board of Trustees, specifying to whom moneys are paid and the amount for traveling expenses or expenses of every nature.

Resolved: That such statements be placed on file for the inspection and information of the members of this Association. (Transactions, 1924, p. 163.)

REGISTRATION AT DETROIT

The House of Delegates at the Cleveland meeting in 1923 by unanimous vote passed an amendment to the Constitution and By-Laws to the effect that the General Secretary is not to issue an admission badge to any dentist living in the United States or its possessions who is not a member of the Association.

Admission to Meetings: Section 1.—Admission to all general sessions, section meetings and clinics of the Association shall be limited to those persons who have received the official badge of the society, issued by the General Secretary.

Section 2.—The General Secretary shall issue membership badges to such members on presentation of their membership cards, or satisfactory evidence of the fact that such cards have been issued.

Section 4.—Guest badges may be issued to all visiting dentists from other countries, to physicians and to nondental friends of members, at the discretion of the General Secretary.

Section 6.—A guest badge may be issued to legally qualified practitioners of dentistry residing outside of the United States and its possessions who present membership cards of recognized dental associations of their provinces or national organization from the country in which said member resides.

It is also very important that every active member bring his 1927 membership card, in order to avoid confusion and delay at the registration window. There will be five full days, Oct. 24-28, 1927.

DELEGATES' CREDENTIALS

Delegates' credential certificates will be sent to the secretaries of all state associations. The state secretaries will see to it that these certificates are signed and delivered to their respective delegates. It is necessary for each delegate to present his credentials, properly signed, to the Committee on Credentials at Detroit in order to be properly enrolled by that Committee, before he can be seated in the House of Delegates.

GENERAL PROGRAM

Registration ..... Monday, October 24, 8:30 a. m.
(Registration Office, Fourth Floor, General Motors Building.)

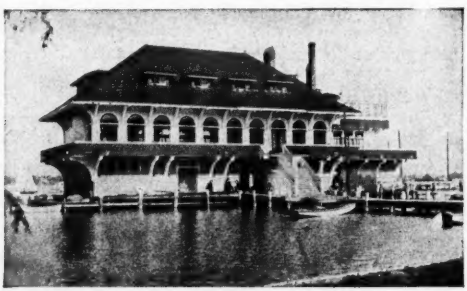
First Meeting of Board of Trustees ..... Saturday, October 22, 10:30 a. m.
(Trustees' Room, Book-Cadillac Hotel)

Second Meeting of Board of Trustees ..... Saturday, October 22, 2:30 p. m.
(Trustees' Room, Book-Cadillac Hotel)

Third Meeting of Board of Trustees ..... Monday, October 24, 9:00 a. m.
(Ballroom, Book-Cadillac Hotel)

(All subsequent meetings will be held in the Trustees' Headquarters [Trustees' Room], General Motors Building)

First Meeting of the House of Delegates ..... Monday, 10:00 a. m.
(Ballroom, Book-Cadillac Hotel)



The Detroit Boat Club, located on Belle Isle, which is a public park of 750 acres situated in the Detroit River between Detroit and Canada.

Second Meeting of the House of Delegates ..... Monday, 2:30 p. m.
(Ballroom, Book-Cadillac Hotel)

Third Meeting of the House of Delegates ..... Wednesday, 2:30 p. m.
(Ballroom, Book-Cadillac Hotel)

Fourth Meeting of the House of Delegates ..... Thursday, 2:30 p. m.
(Ballroom, Book-Cadillac Hotel)

Dental Health Exhibit ..... Monday, 10:00 a. m.
(Dental Exhibit Hall, Fourth Floor, General Motors Building)

The Dental Health Exhibit will be open to the profession, exhibitors, visitors and invited guests on Monday, Tuesday and Wednesday, and until 11:00 a. m., Thursday.

Technical Exhibits ..... Monday, 10:00 a. m.
(Technical Exhibit Hall, General Motors Building)

This technical exhibit will be open during the entire meeting.

Luncheon ..... Monday, 12:10 to 2 p. m.
(Italian Garden, Book-Cadillac Hotel)

The Michigan State Dental Society will give a luncheon to the Officers and Members of the House of Delegates and the American Dental Association.

PRELIMINARY PROGRAM FOR DETROIT SESSION

FIRST GENERAL MEETING

(Auditorium, First Floor, General Motors Building)

TUESDAY, OCTOBER 25, 9:40 A. M.

Music ..... 9:40 to 10:00

Invocation
By Rev. John P. McNichols, S.J., President of the University of Detroit ..... Detroit, Mich.

Music

Address of Welcome on Behalf of the State of Michigan.
By Governor Fred R. Green ..... Lansing, Mich.

Address of Welcome on Behalf of the City of Detroit
By Mayor J. F. Smith ..... Detroit, Mich.

Address of Welcome on Behalf of the University of Michigan
By A. H. Lloyd, President ..... Ann Arbor, Mich.

Address of Welcome on Behalf of the Michigan State Dental Association
By William E. Brown, President ..... Benton Harbor, Mich.

Presentation of Gavel to Henry L. Banzhaf, President of the American Dental Association, on Behalf of the Local Arrangements Committee
By Charles Lane ..... Detroit, Mich.

Response to Addresses of Welcome
By Thomas J. Barrett ..... Worcester, Mass.

Introduction of Distinguished Visitors

President's Address
By Henry L. Banzhaf ..... Milwaukee, Wis.

Adjournment

Exit March

RECEPTION AND LUNCHEON

12:10 to 2:00 P. M.

(Book-Cadillac Hotel)

The First District Dental Society of Detroit, Michigan, will give a reception and luncheon to the distinguished guests and women in attendance.

LUNCHEON CLUB PROGRAM

12:10 to 2:00 P. M.

THE SCIENTIFIC SECTIONS

TUESDAY, OCTOBER 25

OPERATIVE DENTISTRY, MATERIA MEDICA AND THERAPEUTICS

(Auditorium A, General Motors Building. All subsequent meetings will be held in the same place.)

OFFICERS OF SECTION

M. M. Printz, Chairman ..... Chicago, Ill.
George W. Hillias, Vice-Chairman ..... Kansas City, Mo.
Herbert E. Phillips, Secretary ..... Chicago, Ill.

2 to 5 p. m.

"The Nutritional Crisis During Pregnancy and Lactation"
By Sherman L. Davis (A.B., A.M., Ph.D.) ..... Bloomington, Ind.
Discussed by
Percy R. Howe ..... Boston, Mass.
Icie G. Macy (Ph.D.) ..... Detroit, Mich.

"The Forces of Occlusion and Their Relation to Operative Dentistry"
By Martin Dewey ..... New York City
Discussed by
Abram Hoffman ..... Buffalo, N. Y.
Austin F. James ..... Chicago, Ill.

"Radiography as an Efficiency and Economic Factor in Operative Dentistry"
By Clarence O. Simpson ..... St. Louis, Mo.
Discussed by
Edgar D. Coolidge ..... Chicago, Ill.
C. Edmund Kells ..... New Orleans, La.

FULL DENTURE PROSTHESIS

(Auditorium B, General Motors Building. All subsequent meetings will be held in the same place.)

OFFICERS OF SECTION

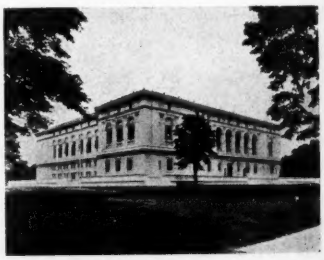
William M. Randall, Chairman ..... Louisville, Ky.
Russell W. Tench, Vice-Chairman ..... New York City
I. V. Duell, Secretary ..... Louisville, Ky.

2 to 5 p. m.

"Some Essentials in Full Denture Service"
By H. V. Cottrell ..... Columbus, Ohio
Discussed by
I. V. Duell ..... Louisville, Ky.

"Mechano-Anatomic Influences in Esthetic Arrangement of Artificial Teeth"
By A. K. Parks ..... Montgomery, Ala.
Discussed by
Russell W. Tench ..... New York City

"A Method of Transferring the Mandibular Movements to the Dental Laboratory"
By Ira G. Nichols ..... Champaign, Ill.
Discussed by
R. R. Blanchard ..... Springfield, Ill.



Detroit's new public library.

"Metal Bases for Full Dentures"
By W. J. Pryor ..... Cleveland, Ohio
Discussed by
I. Lester Furnas ..... Cleveland, Ohio

PARTIAL DENTURE PROSTHESIS

(Auditorium D, General Motors Building. All subsequent meetings will be held in the same place.)

OFFICERS OF SECTION

James C. Mortonson, Chairman ..... Milwaukee, Wis.
Morton H. Mortonson, Vice-Chairman ..... Milwaukee, Wis.
B. B. McCollum, Secretary ..... Los Angeles, Calif.

2 to 3:30 p. m.

"The Problem of the Partial Denture and Its Rational Solution"
By Herman E. S. Chayes..New York City
Discussed by
Nye White Goodman Los Angeles, Calif.
M. Diamond.....New York City

3:30 to 5 p. m.

"Periodontoclasia; Its Significance in the Field of Partial Restoration"
By Paul R. Stillman.....New York City
Discussed by
Clarence B. Vaughn.....Boston, Mass.
Austin F. James.....Chicago, Ill.

ORAL SURGERY, EXODONTIA AND ANESTHESIA

(Auditorium E, General Motors Building. All subsequent meetings will be held in the same place.)

OFFICERS OF SECTION

James A. Blue, Chairman....Birmingham, Ala.
Joseph P. Wahl, Vice-Chairman.....New Orleans, La.
A. L. Frew, Secretary.....Dallas, Texas

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2 to 5 p. m.

"Radiographic Interpretation of the Various Types of Impacted Mandibular Third Molar from Which a Definite Operative Technic Can Be Analyzed"
By Frank W. Rounds.....Boston, Mass.
"Operative Technic for the Removal of the Various Types of Impacted Mandibular Third Molar"
By George B. Winter.....St. Louis, Mo.
"Postoperative Treatment After the Removal of the Impacted Mandibular Third Molar"
By George C. Fahy....New Haven, Conn.

ORTHODONTIA AND PERIODONTIA

(Auditorium H, General Motors Building. All subsequent meetings will be held in the same place.)

OFFICERS OF SECTION

B. Frank Gray, Chairman.....San Francisco, Calif.
Arthur H. Merritt, Vice-Chairman.....New York City
Charles R. Baker, Secretary.....Evanston, Ill.

2 to 5 p. m.

Periodontia

"The Etiologic Factors in Periodontal Lesions"
A. "Oral Sepsis"
By Grace Rogers Spalding.....Birmingham, Mich.
B. "Occlusion"
By Alfred LeRoy Johnson.....Philadelphia, Pa.
C. "Disuse Atrophy"
By Hugh W. MacMillan.....Cincinnati, Ohio
D. "Bacteria"
By Thomas B. Hartzell.....Minneapolis, Minn.
E. "Diet"
By Benjamin Tishler.....Boston, Mass.

MOUTH HYGIENE AND PREVENTIVE DENTISTRY

(Auditorium I, General Motors Building. All subsequent meetings will be held in the same place.)

OFFICERS OF SECTION

R. S. Towne, Chairman.....Bismarck, N. D.
L. P. Bethel, Vice-Chairman....Columbus, Ohio
G. H. Wandel, Secretary.....Iowa City, Iowa

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2 to 5 p. m.

"Preventive Dentistry as a Public Health Problem"
By Guy L. Kiefer (M.D.).....Lansing, Mich.
Discussed by
Harold DeW. Cross.....Boston, Mass.
"Tendencies in Health Education"
By F. L. Rector (M.D.).....Chicago, Ill.
"Dental Clinic Policy"
By Clare Terwilliger.....New York City
"How to Win the Game"
By Stanley R. Meaker.....Albany, N. Y.
Discussed by
C. J. Hollister.....Harrisburg, Pa.

HISTOLOGY, PHYSIOLOGY, PATHOLOGY, BACTERIOLOGY AND CHEMISTRY (RESEARCH)

(Auditorium G, General Motors Building. All subsequent meetings will be held in the same place.)

OFFICERS OF SECTION

Russell W. Bunting, Chairman.....Ann Arbor, Mich.

"The Biometric Consideration of the Cells in Normal Blood"

By Irwin A. Epstein.....St. Paul, Minn.

"Experimental Glomerulonephritis in the Monkey, Induced by Streptococcus Viridans"

By Thomas B. Hartzell.....Minneapolis, Minn.

Savoy Hotel, Detroit, Mich.

F. V. Simonton, Vice-Chairman.....San Francisco, Calif.

Edward H. Hatton, Secretary....Chicago, Ill.

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2 to 5 p. m.

"Histologic Studies of Tooth Movement (Drifting)"

By B. Orbán.....Vienna, Austria

"Changes in Blood Morphology Following the Removal of Pulpless Teeth"

By A. W. Bryan.....Iowa City, Iowa

"Histologic Studies of Teeth and Investing Tissue, Showing the Changes Due to Unusual Stress"

By Stanley D. Tylman.....Chicago, Ill.

"Structural Variations in Enamel and Dentin of Human Teeth"

By Lawrence Edward VanKirk.....Pittsburgh, Pa.

"Dental Survey of 1,000 Adult Males. A Statistical Study Correlated with Physical and Laboratory Findings"

By H. C. Cramer.....Battle Creek, Mich.

SECOND GENERAL MEETING

8 p. m.

(Ballroom, Book-Cadillac Hotel)

Henry L. Banzhaf, President-Chairman.....Milwaukee, Wis.

"Fads, Fallacies and Fakes"
By Morris Fishbein (M.D.).....Chicago, Ill.

WEDNESDAY, OCTOBER 26

OPERATIVE DENTISTRY, MATERIA MEDICA AND THERAPEUTICS

(Auditorium A. All subsequent meetings will be held in the same place.)

9 a. m. to 12 m.

"Some Modifications in Cavity Preparation, Regarding the Teeth as Vital Organs, with Suggestions for Filling"
By James Mark Prime.....Omaha, Nebr.
Discussed by
H. E. Friesell.....Pittsburgh, Pa.
Arthur R. McDowell.....San Francisco, Calif.

"The Value of Gold Foil in Modern Practice"
By C. N. Johnson.....Chicago, Ill.
Discussed by
Perry F. Gilbreath.....Kansas City, Mo.
W. A. Finn.....Pittsburgh, Pa.

"The Cause of Failures in Alloy Work and How to Avoid Them"
By DeLos L. Hill.....Atlanta, Ga.
Discussed by
O. J. Olafsson.....Chicago, Ill.
J. J. Clarke.....Artesia, N. M.

"Alloy Research Report"
By Wilmer J. Souder (Ph.D.).....Washington, D. C.

FULL DENTURE PROSTHESIS

(Auditorium B. All subsequent meetings will be held in the same place.)

9 a. m. to 12 m.

Symposium—"Balanced Occlusion"

A. "Anatomic Influences on Balanced Jaw Relations and Balanced Occlusion"
By W. H. Wright.....Wilkinsburg, Pa.
Discussed by
Dayton Dunbar Campbell.....Kansas City, Mo.

B. "The Relations of Physics and Physiology to Balanced Occlusion"
By R. O. Schlosser.....Chicago, Ill.
Discussed by
J. W. Crawford.....Milwaukee, Wis.

C. "Occlusal Forms as Related to Tissue Trauma"
By Victor H. Sears.....New York City
Discussed by
Abram Hoffman.....Buffalo, N. Y.

D. "Influence of Mandibular Movement on Balanced Occlusion"
By A. H. Paterson.....Baltimore, Md.
Discussed by
Walter E. Beyer.....Indianapolis, Ind.

PARTIAL DENTURE PROSTHESIS

(Auditorium D. All subsequent meetings will be held in the same place.)

9 to 10:30 a. m.

"The Necessity of Establishing Centric Relation and Balanced Occlusion in Open Bite Crown and Bridge Cases"
By T. W. Maves.....Cleveland, Ohio
Discussed by
O. DeForest Davis.....Minneapolis, Minn.
Treve Jones.....Portland, Ore.

10:30 a. m. to 12 m.

"The Radiogram as an Aid in the Planning of Partial Restoration"
By John Oppie McCall.....New York City
Discussed by
Clarence O. Simpson.....St. Louis, Mo.
Hugh W. MacMillan.....Cincinnati, Ohio

ORAL SURGERY, EXODONTIA AND ANESTHESIA

(Auditorium E. All subsequent meetings will be held in the same place.)

9 a. m. to 12 m.

"Dental Cysts and Their Surgical Treatment"
By Emil L. Aison.....Chicago, Ill.
Discussed by
Theodor Blum.....New York City
E. C. Hume.....Louisville, Ky.

"Cleft Palate and Cleft Lip"
By William L. Shearer.....Omaha, Nebr.
Discussed by
Truman W. Brophy.....Chicago, Ill.
A. L. Frew.....Dallas, Texas

"Malpositions and Complications of the Mandibular Third Molar, Operative and Postoperative Care"
By M. N. Federspiel....Milwaukee, Wis.
"Vincent's Disease"
By Arnott A. Moore.....Buffalo, N. Y.
Discussed by
J. P. Wahl.....New Orleans, La.
W. S. Wilson.....Birmingham, Ala.
Steinbrecher.....Milwaukee, Wis.

ORTHODONTIA AND PERIODONTIA

(Auditorium H. All subsequent meetings will be held in the same place.)

9 a. m. to 12 m.

President's Address
By B. Frank Gray....San Francisco, Calif.
"Local and Mechanical Causes of Malocclusion"
By H. W. McClain .....Chicago, Ill.
Discussed by
J. D. Locke.....Grand Rapids, Mich.
"Habits as Causative Factors in Malocclusion"
By W. E. Flesher..Oklahoma City, Okla.
Discussed by
Ernest N. Bach.....Toledo, Ohio
"Nasal and Pharyngeal Conditions as Causative Factors in Malocclusion"
By B. G. DeVries.....Minneapolis, Minn.
Discussed by
Abram Hoffman.....Buffalo, N. Y.

MOUTH HYGIENE AND PREVENTIVE DENTISTRY

(Auditorium I. All subsequent meetings will be held in the same place.)

9 a. m. to 12 m.

"Nutrition"
By Sherman L. Davis (A.B., A.M., Ph.D.) .....Bloomington, Ind.
Discussed by
Edward H. Hatton.....Chicago, Ill.
"Mouth Hygiene and Child Health"
By William DeKleine (M.D.).....Fargo, N. D.
"Teaching Mouth Hygiene in Teachers' Colleges and Normal Schools"
By Alice Conger Hunter.....Des Moines, Iowa
"The Training of Dental Hygienists and Their Relation to the General Mouth Hygiene Problem"
By Dorothy G. Hard....Ann Arbor, Mich.

HISTOLOGY, PHYSIOLOGY, PATHOLOGY, BACTERIOLOGY AND CHEMISTRY (RESEARCH)

(Auditorium G. All subsequent meetings will be held in the same place.)

9 a. m. to 12 m.

"Experimental Studies on the Power of Human Enamel to Absorb Dyes from the Pulp"
By William Hopkinson and Matilda
"Structure of the Dental Enamel; the Innervation of the Dental Pulp"
By Samuel H. Chase.....Madison, Wis.
"Intrafollicular Enamel Development"
By Theodore B. Beust.....Louisville, Ky.
"The Enamel Lamellae"
By Charles F. Bödecker....New York City
"The Causes of Variation in Salivary Calcium; Their Relation to Susceptibility and Immunity to Dental Caries"
By Harold J. Leonard....Milwaukee, Wis.
"Dental Disease and Dietary Habits in Korea; a Method of Analyzing Statistical Results"
By George B. Denton (Ph.D.).....Chicago, Ill.
J. L. Boots.....New Brighton, Pa.

OPERATIVE DENTISTRY, MATERIA MEDICA AND THERAPEUTICS

(Auditorium A. All subsequent meetings will be held in the same place.)

2 to 5 p. m.

"Porcelain Inlays and Their Substitutes"
By Malvern D. Huff ..... Atlanta, Ga.
Discussed by
Albert L. LeGro.....Detroit, Mich.
George A. Thompson.....Chicago, Ill.
"The Place the Porcelain Jacket Crown Should Occupy"
By C. G. Parker.....Detroit, Mich.
Discussed by
E. B. Spalding.....Birmingham, Mich.
W. L. Fickes.....Pittsburgh, Pa.
"Conservative Use of Silicate Cements"
By D. N. Lewis.....Lake Forest, Ill.
Discussed by
M. L. Christensen.....Oshkosh, Wis.
Charles W. Strosnider....Columbus, Ohio

Grand Circus Park, looking south.

FULL DENTURE PROSTHESIS

(Auditorium B. All subsequent meetings will be held in the same place.)

2 to 5 p. m.

Symposium—"Methods"

A. "Interpretation of the Laws of Occlusion"
By Felix A. French.....Ottawa, Canada
Discussed by
George P. Phillips.....Boston, Mass.

B. "Registration and Reproduction of Mandibular Relations and Movements"
By Rupert E. Hall.....Chicago, Ill.
Discussed by
Robert R. Gillis.....Hammond, Ind.

C. "Plastic Registrations of Mandibular Relations"
By John H. Hospers.....Chicago, Ill.
Discussed by
George P. Brenner.....Milwaukee, Wis.

D. "The Futility of the Face-Bow"
By C. J. Stansbery.....Seattle, Wash.
Discussed by
Charles A. Mathias.....Louisville, Ky.

PARTIAL DENTURE PROSTHESIS

(Auditorium D. All subsequent meetings will be held in the same place.)

2 to 3:30 p. m.

"New Preparations for Jacket Crowns"
By George A. Thompson....Chicago, Ill.
Discussed by
William A. Squires.....New York City
Hugh Avary.....San Francisco, Calif.

3:30 to 5 p. m.

"Physiology and Mechanics of Human Teeth"
By James Mark Prime.....Omaha, Nebr.
Discussed by
T. W. Maves.....Cleveland, Ohio
Frank A. Hamilton.....Indianapolis, Ind.

ORAL SURGERY, EXODONTIA AND ANESTHESIA

(Auditorium E. All subsequent meetings will be held in the same place.)

2 to 5 p. m.

"General Anesthesia in the Practice of Exodontia"
By J. P. Henahan.....Cleveland, Ohio
Discussed by
Edward L. Moravec.....Cedar Rapids, Iowa
Martin L. DeBats.....Detroit, Mich.

"Bony Ankylosis of the Jaw"
By James O. Beavis.....Ann Arbor, Mich.
Discussed by
Herbert A. Potts.....Chicago, Ill.
V. H. Kazanjian.....Boston, Mass.

"Dental Radiography"
By Frederick F. Molt.....Chicago, Ill.
Discussed by
E. W. Browning.....Salt Lake City, Utah
Clarence O. Simpson.....St. Louis, Mo.

ORTHODONTIA AND PERIODONTIA

(Auditorium H. All subsequent meetings will be held in the same place.)

2 to 5 p. m.

Periodontia

"A Discussion of the Histologic Changes Occurring in the Supporting Tissues of the Teeth, and Their Causes"
By F. B. Noyes.....Chicago, Ill.

MOUTH HYGIENE AND PREVENTIVE DENTISTRY

(Auditorium I. All subsequent meetings will be held in the same place.)

2 to 5 p. m.

"Fundamentals in Health Education"
By Marjorie Delevan.....Lansing, Mich.
Discussed by
Gladys Eyrich.....Jackson, Miss.

"The Lay Educational Program Used by the Cleveland Dental Society"
By P. J. Aufderheide.....Cleveland, Ohio
Discussed by
Charles B. Fowlks.....New York City

"The Nurse and Teacher in a Dental Health Program"
By William R. Davis.....Lansing, Mich.
Discussed by
G. H. Wandel.....Iowa City, Iowa

"The Public and Professional Usefulness of the Dental Hygienist"
By Ethel Covington.....Denver, Colo.

HISTOLOGY, PHYSIOLOGY, PATHOLOGY, BACTERIOLOGY AND CHEMISTRY (RESEARCH)

(Auditorium G. All subsequent meetings will be held in the same place.)

2 to 5 p. m.

"A New Medium for Growing Mouth Organisms"
By G. F. Roberts.....Buffalo, N. Y.

David Whitney Building.

"Studies on Anaerobic Organisms of the Mouth"
By Philip Jay.....Rochester, N. Y.

"Further Studies on the Etiology of Pulp Canal Infections and Treatment"
By U. G. Rickert and Faith P. Hadley (M.S.).....Ann Arbor, Mich.

"Further Studies of the Relation of Bacillus Acidophilus to Dental Caries. II"
By Russell W. Bunting, Gail Nickerson (B.S.), Dorothy G. Hard and Mary C. Crowley (A.B.).....Ann Arbor, Mich.

"Root Canal Treatment in Chronic Abscess Cases"
By Ira G. Nichols.....Champaign, Ill.

"Further Studies on the Virulence of Streptococci"
By Anna C. Nichols (B.S., M.S.).....Chicago, Ill.
T. F. O'Dea.....Newark, N. J.
Edward H. Hatton.....Chicago, Ill.

"The Mechanism of the Germicidal Action of Soaps"
By Thomas B. Hartzell and W. P. Larson.....Minneapolis, Minn.

"Occurrence of Elastic Fibers in the Peridental Membrane"
By Newton G. Thomas.....Pittsburgh, Pa.

THIRD MEETING OF HOUSE OF DELEGATES

(Ballroom, Book-Cadillac Hotel)

2:30 p. m.

THIRD GENERAL MEETING

(Ballroom, Book-Cadillac Hotel)

7:45 p. m.

Henry L. Banzhaf, President A. D. A., Chairman.....Milwaukee, Wis.

Vocal Solo

"The Organized Movement for the Control of Cancer in America"
By George A. Soper (Ph.D.).....New York City
Managing Director, American Society for the Control of Cancer.

"Cancer of the Mouth with Special Reference to Precancerous Conditions and Prophylaxis"
By Joseph Colt Bloodgood (M.D.).....Baltimore, Md.

THURSDAY, OCTOBER 27

OPERATIVE DENTISTRY, MATERIA MEDICA AND THERAPEUTICS

(Auditorium A)

9 a. m. to 12 m.

"Root Canal Treatment of Vital and Pulpless Teeth Preparatory to Crown and Bridge Attachment"
By J. J. Moffitt.....Harrisburg, Pa.
Discussed by
Arthur H. Merritt.....New York City
Paul C. Kitchen.....Columbus, Ohio

"Gold Inlays"
By Albert P. Grunn.....Chicago, Ill.
Discussed by
Morton H. Mortonson.....Milwaukee, Wis.
R. H. Volland.....Iowa City, Iowa

"Progress in Operative Dentistry in Recent Years"
By Arthur D. Black.....Chicago, Ill.
Discussed by
John V. Conzett.....Dubuque, Iowa
George H. Means.....Louisville, Ky.

FULL DENTURE PROSTHESIS

(Auditorium B)

9 a. m. to 12 m.

"Expression"
By B. L. Hooper.....Lincoln, Nebr.
Discussed by
F. M. Hight.....Houston, Texas

"Photography and Its Uses"
By Edward H. Bruening.....Omaha, Nebr.
Discussed by
John B. LaDue.....Chicago, Ill.

"Fundamentals of Art as Applied to Denture Service"
By A. Alfred Nelson.....Detroit, Mich.
Discussed by
E. B. Owen.....St. Louis, Mo.

"Predetermining Supporting Tissue Conditions for Full Dentures"
By Howard H. Jackson.....Detroit, Mich.
Discussed by
Hugh W. MacMillan.....Cincinnati, Ohio

PARTIAL DENTURE PROSTHESIS

(Auditorium D)

9 to 10:30 a. m.

"Construction of Cast Gold Partial Dentures. An Accurate Sectional Impression Technic a Primary Necessity"
By M. B. Rudd.....Richmond, Va.
Discussed by
R. D. Thornton and R. L. Simpson
.....Richmond, Va.

10:30 a. m. to 12 m.

Logic and Basic Principles Applied to the Partial Denture Problem"
By A. Alfred Nelson.....Detroit, Mich.
Discussed by
J. W. Crawford.....Milwaukee, Wis.
W. E. Cummer.....Toronto, Canada

ORAL SURGERY, EXODONTIA AND ANESTHESIA

(Auditorium E)

9 a. m. to 12 m.

"Focal Infection"
By Boyd S. Gardner.....Rochester, Minn.
Discussed by
Weston A. Price.....Cleveland, Ohio

"Surgical Technic for Blocking the Gasserian Ganglion in the Treatment of Tic Douloureux"
By Arthur E. Smith.....Los Angeles, Calif.
Discussed by
F. B. Moorehead.....Chicago, Ill.
Leroy M. S. Miner.....Boston, Mass.

"Postoperative Pain. Its Causes, Prevention and Treatment, Relating Specifically to Postextraction Pain"
By Roy S. Hopkinson.....Milwaukee, Wis.
Discussed by
R. Boyd Bogle.....Nashville, Tenn.
Boyd S. Gardner.....Rochester, Minn.

ORTHODONTIA AND PERIODONTIA

(Auditorium H)

9 a. m. to 12 m.

Orthodontia

"Systemic Conditions as Causative Factors in Malocclusion"
By Samuel J. Lewis.....Detroit, Mich.
Discussed by
Lloyd S. Lourie.....Chicago, Ill.

"Inherited and Congenital Causative Factors in Malocclusion"
By Frank M. Casto.....Cleveland, Ohio
Discussed by
O. W. White.....Detroit, Mich.

"Muscular Exercises as a Factor in Orthodontic Treatment"
By Alfred P. Rogers.....Boston, Mass.
Discussed by
V. E. Barnes.....Cleveland, Ohio

MOUTH HYGIENE AND PREVENTIVE DENTISTRY

(Auditorium I)

9 a. m. to 12 m.

"The Problem of Constructing a Comprehensive Preventive Dental Program in a Large Community"
By Emmerson R. Sausser.....
.....Philadelphia, Pa.

Symposium and Demonstration—"Methods of Mouth Brushing"

By A. C. Fones.....Bridgeport, Conn.
W. J. Charters.....Des Moines, Iowa
E. L. Pettibone.....Cleveland, Ohio
Frederick A. Bricker.....
.....Hollywood, Calif.

HISTOLOGY, PHYSIOLOGY, PATHOLOGY, BACTERIOLOGY AND CHEMISTRY (RESEARCH)

(Auditorium G)

9 a. m. to 12 m.

"Studies in Calcification and Decalcification"

By Ernest Pond (M.D.).....
.....Philadelphia, Pa.

"Metabolism and Teeth"

By Percy R. Howe.....Boston, Mass.

"Calcium Metabolism Studies on the Nature and Rôle of the Activators"

By Weston A. Price.....Cleveland, Ohio

FOURTH MEETING OF HOUSE OF DELEGATES

2:30 p. m.

(Ballroom, Book-Cadillac Hotel)

FOURTH GENERAL MEETING

8:00 p. m.

(Ballroom, Book-Cadillac Hotel)

A program of entertainment will be furnished by Local Arrangements Committee.)

CLINIC PROGRAM

THURSDAY, OCTOBER 27

(Clinic Halls, General Motors Building)
Robert L. Sprau, Chairman.....Louisville, Ky.
Edgar L. Giffen, Local Chairman.....
.....Detroit, Mich.

RULES GOVERNING CLINICS

The General Clinics will be held in the General Motors Building. Three half-days will be devoted to clinics: Thursday afternoon, 2-5, Friday morning, 9-12 and Friday afternoon, 2-5 o'clock.

There will be six general groups of clinics: Section Clinics, under the direction of the officers of the Sections; College Clinics (colleges have been requested to furnish five table clinics); State Association Individual Clinics (each state association is requested to furnish one table clinic for each delegate; State Association Group or Study Club Clinics (each state association is requested to furnish one group clinic not to exceed ten men); Foreign Clinics—Foreign countries have been invited to present clinics. Canada will be well represented. Michigan, being the host, will present the Friday afternoon clinics.

Clinics in the foregoing groups must be approved by the officers of the organization which they represent. Clinicians not heretofore enlisted will please communicate with the officers of their various organizations, that all quotas may be filled.

SECTION CLINICS

OPERATIVE DENTISTRY, MATERIA MEDICA AND THERAPEUTICS

(Auditorium A)

2 to 5 p. m.

"Gold Inlays"

By Albert P. Grunn.....Chicago, Ill.

"New Method and Technic of Filling Root Canals"

By J. P. Buckley.....Los Angeles, Calif.

FULL DENTURE PROSTHESIS

(Auditorium B)

2 to 5 p. m.

"Recording Expression, External Dimensions and Color for Full Dentures"

By Edward H. Bruening.....Omaha, Nebr.

"Some Full Denture Essentials"

By H. V. Cottrell.....Columbus, Ohio

"Modeling Compound Technic of Taking a Negative Pressure Impression"

By I. V. Duell.....Louisville, Ky.

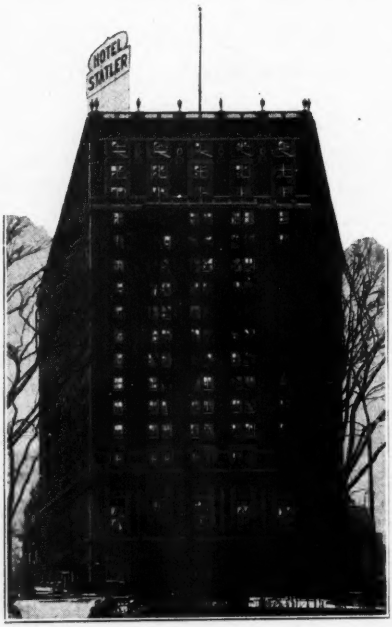
"The Lost Dimension"

By A. K. Parks.....Montgomery, Ala.

"Reproducing Mandibular Movements in a Laboratory"
By Ira G. Nichols.....Champaign, Ill.

"Swaged Bases for Full Dentures"
By W. J. Pryor.....Cleveland, Ohio

"Anatomic Influences on Jaw Relations"
By W. H. Wright.....Wilkinsburg, Pa.



Hotel Statler, Detroit, Mich.

"Cast Aluminum Bases; How, When and Where"
By Dayton Dunbar Campbell.....Kansas City, Mo.

"Physics and Physiology of Full Dentures"
By R. O. Schlosser.....Chicago, Ill.

"Artificial Posterior Dentures"
By Victor H. Sears.....New York City

"Patterns of Occlusal Plane Produced by the Patient and What To Do with Them"
By A. H. Paterson.....Baltimore, Md.

"Case Showing Unusual Bite and Condyle Path"
By Walter E. Beyer.....Indianapolis, Ind.

"Interpretation of the Laws of Occlusion"
By Felix A. French.....Ottawa, Canada

"Functional Interdigitation of the Teeth in Full Dentures"
By George P. Phillips.....Boston, Mass.

"Reproduction of Mandibular Movements"
By Rupert E. Hall.....Chicago, Ill.

"A Mechanical Aid for Taking the Bite"
By Robert R. Gillis.....Hammond, Ind.

"Plastic Registrations of Mandibular Movements"
By John H. Hospers.....Chicago, Ill.

"How to Do Without the Face Bowl"
By C. J. Stansbery.....Seattle, Wash.

"Expression"
By B. L. Hooper.....Lincoln, Nebr.

PARTIAL DENTURE PROSTHESIS

(Auditorium D)

2 to 5 p. m.

"Metallurgic Factors in Partial Denture Construction"
By Louis J. Weinstein.....New York City

ORAL SURGERY, EXODONTIA AND ANESTHESIA

(Auditorium E)

2 to 5 p. m.

"The Armamentarium, Preliminary Technic, and Procedure in Mouth Surgery, for the Novice as Well as the Experienced Operator"
By Rush P. Abbott.....West Point, Miss.

ORTHODONTIA AND PERIODONTIA

(Auditorium H)

2 to 5 p. m.

Periodontia

Lecture clinic

MOUTH HYGIENE AND PREVENTIVE DENTISTRY

(Auditorium I)

2 to 5 p. m.

Table Clinics and Demonstrations Covering Different Phases of Children's Dentistry
By Thaddeus P. Hyatt....New York City
Harris R. C. Wilson.....Cleveland, Ohio
Guy S. Lerch.....Cleveland, Ohio
F. B. Rhobotham.....Chicago, Ill.
C. L. Drain.....Iowa City, Iowa

COLLEGE CLINICS

(Clinic Hall, General Motors Building)

College of Physicians and Surgeons of San Francisco

A. R. McDowell, Dean.

"Some Features of Oral Surgery Technic"
By Sanford M. Moose

"Radiographic Interpretation"
By Walter S. Thompson

"Anesthesia for the General Practitioner"
By Frank L. Platt

"Models and Technic Used in Teaching Operative Dentistry"
By Arthur R. McDowell

Indiana University, School of Dentistry, Indianapolis, Ind.

F. R. Henshaw, Dean.

"Selection and Modification of Porcelain Teeth for Practical Dentures"
By Frank C. Hughes

"Partial Veneer Cast Crowns"
By Ert J. Rodgers

"Pinlays"
By Jeane T. Waldo

"Gold Foil"
By John Lacey Wilson

"Radiographic Exhibit and Interpretation"
By Eugene Buck

Chicago College of Dental Surgery, Dental Department of Loyola University

W. H. G. Logan, Dean.

"Porcelain Jack Crown"
By Harold W. Oppice and associates

"Full Denture"
By Elbert C. Pendleton and Henry Glupker

Ohio State University, College of Dentistry

H. M. Semans, Dean.

"Phases of Student Bridge Technic"
By Frank C. Starr

"Plate Technic"
By H. V. Cottrell and H. S. Shumway

"Plaster Models and Forms"
By C. W. Strosnider and L. E. Reif

Hotel Tuller, Detroit, Mich.

Tufts College, Dental School

William Rice, Dean.

"Application of the Principle of Slight Mobility to Fixed Bridgework"
By W. G. Bridge

"Root Canal Technic and Therapy and Classification of Cases and Records"
By Bernard Berg

Washington University, School of Dentistry

"Fixed Bridgework"
By J. D. White

GROUP AND STUDY CLUB CLINICS

(Clinic Hall, General Motors Building)

2 to 5 p. m.

KENTUCKY

"Porcelain Tip Pontics Without Use of Furnace for Bridgework, and Gold Abutments for Bridgework"
By Garnett H. Smith and W. W. Rivers ..... Louisville

MISSOURI

Kansas City Crown and Bridge Unit
By V. V. Bele
F. E. Byers
C. E. Burgson
C. C. Freeney
P. F. Gilbreath
L. N. Glaze
J. E. Huff
J. D. Scott
J. C. Warnock
E. Westenhaver
R. J. Rinehart

OKLAHOMA

"Investment and Preparation for Models for Inlays"
By G. A. Poelke and A. L. Waters ..... Tulsa

Joint Clinic
By E. E. Overmeyer and J. T. Roberts ..... Muskogee

FRIDAY, OCTOBER 28

SECTION CLINICS

9 a. m. to 12 m.

OPERATIVE DENTISTRY, MATERIA MEDICA AND THERAPEUTICS

(Auditorium A)

"Porcelain Jacket Crown Preparation"
By C. G. Parker ..... Detroit, Mich.

FULL DENTURE PROSTHESIS

(Auditorium B)

"Central Occlusions Secured Scientifically; Sagittal Plane Inclination Reproduced for Balanced Occlusion"
By F. M. Hight ..... Houston, Texas

"Art Applied to Dentures"
By A. Alfred Nelson ..... Detroit, Mich.

"A New Method of Denture Construction"
By A. Y. Russell ..... Baltimore, Md.

"An Edentulous Case with Unusual Condylar Conditions"
By E. B. Owen ..... St. Louis, Mo.

"A Step Technic in Full Denture Construction"
By E. C. Pendleton and Henry Glupker ..... Chicago, Ill.

"Full Upper and Lower Impressions"
By Joseph P. Cruise ..... Chicago, Ill.

"Full Denture Construction"
By J. S. Kellogg ..... Chicago, Ill.

"Problems in Denture Construction and Technic of Rebasing Full Lower Dentures"
By R. H. Snyder ..... Chicago, Ill.

"Continuous Gum Dentures"
By O. E. Cassill ..... Chicago, Ill.

"Predetermining Supporting Tissue Conditions for Full Dentures"
By H. H. Jackson ..... Detroit, Mich.

"Methods of Preserving Facial Dimensions and Central Occlusion After Natural Teeth Are Lost"
By J. Mark Prime ..... Omaha, Nebr.

"Full Denture Technic Center of Rotation and Cusp Travel"
By Chester C. Miller and Albert Stanley ..... Indianapolis, Ind.

"Occlusion, Jaw Relations and Ridge Relations"
By A. E. Boyce ..... Tuscola, Ill.

"Laws of Articulation Elucidated by Mounted Dentures"
By Rudolph L. Hanau ..... Buffalo, N. Y.

"Application of Various Technics to the Gysi Articulator"
By Winthrop C. Whittemore ..... New York City

"Immediate Denture Service"
By D. Alphonsus P. O'Hare ..... St. Louis, Mo.

"An Impression Technic with Special Attention to Mandibular Tissue Conditions and to Area to Be Covered"
By O. M. Dressen ..... Milwaukee, Wis.

PARTIAL DENTURE PROSTHESIS

(Auditorium D)

"Basic Principles in Partial Denture Prosthesis"
By A. Alfred Nelson ..... Detroit, Mich.

"Porcelain Jacket Crown Technic; Consecutive Steps in Detail"
By Nye White Goodman.....Los Angeles, Calif.

"Opening the Bite in Reconstruction Cases and Maintaining Correct Maxillomandibular Relations"
By Joseph Homer.....New York City

"A Technic for Construction of Cast Gold Partial Dentures"
By M. B. Rudd, R. D. Thornton and R. L. Simpson.....Richmond, Va.

ORAL SURGERY, EXODONTIA AND ANESTHESIA

(Auditorium E)

"Operative Findings as Compared with Radiographic Diagnosis"
By Menifee R. Howard.....Denver, Colo.

ORTHODONTIA AND PERIODONTIA

(Auditorium H)

Orthodontia

"Removable Lingual Orthodontic Appliances"
By Oren A. Oliver.....Nashville, Tenn.

STATE INDIVIDUAL CLINICS

(Clinic Hall, General Motors Building)

ARMY DENTAL CORPS

"Modified Compound Full Denture Impression Technic"
By Daniel L. Lockwood.....Washington, D. C.

INDIANA

"Study Club Activities in Indiana"
By J. F. Johnston.....Indianapolis

"A Method of Recording Definite Measurements Before Extraction Preparatory to Denture Construction"
By A. L. Harter.....Kokomo

"Vincent's Infection—Microscopic Examination"
By George E. Meeker.....Peru

"How to Control Shrinkage in Large Gold Inlays"
By C. E. McCready.....Gary

"Sarcoma of the Mandible Caused by Impacted Third Molar"
By V. H. Hilgemann.....Fort Wayne

"Correction of Impacted Cuspid"
By Harry G. Jones.....Indianapolis

"Full Denture Construction, Wadsworth Technic"
By R. H. Hopkins.....Indianapolis

IOWA

"Immunizing Mouth Tissue, Both Hard and Soft, to Infections by Correct Stimulation with the Toothbrush"
By W. J. Charters.....Des Moines

"Staining Porcelain Teeth"
By C. E. Westwood.....Sioux City

"Exhibition of Wax Pattern Expansion Control Cabinet"
By C. A. DeLano.....Cedar Rapids

Horticultural Hall on Belle Isle.

KENTUCKY

"Porcelain Jacket, Pontics, Inlays and Stain"
By J. Bernard Hutcherson.....Louisville

"Restoration of Point Angle on Anterior Teeth with Synthetic Porcelain"
By I. D. Best.....Lexington

"Method of Obtaining Wax Pattern for Carmichaels and Inlays"
By W. C. Tippett.....Louisville

"Round Wire Clasps and Stress Breaker Attachments for Partial Dentures"
By James F. Owen.....Lexington

"Importance of the Face Bow in All Metal Adjustable Articulators"
By C. A. Mathias.....Louisville

MAINE

"Porcelain Technic"
By George J. Anderson ..... Portland

MISSOURI

"Rizadontia"
By J. A. Walther ..... St. Louis

"Fixed Bridgework, Types of Attachments. Pontics and Construction"
By George B. Scott ..... St. Louis

"New Developments with the Wax Spray Method for Facial Casts, Using the Alternating Current Magnet Principle for Vibrating Stone Casts 7,200 Times per Minute"
By Eric H. Golden ..... St. Louis

"Seibert Reinforced Silicate Angle Restoration"
By J. W. Ford ..... St. Louis

"Study of Tooth Form"
By R. C. Wheeler and H. R. Faherty ..... St. Louis

"Full Denture Technic"
By A. T. Gast ..... St. Louis

OKLAHOMA

"Interior Anchorage for the Three-Quarter Crown"
By E. L. Miley ..... Oklahoma City

"Natural Teeth for Bridge Restoration"
By A. E. Bonnell ..... Muskogee

FRIDAY, OCTOBER 28

2 to 5 p. m.

MICHIGAN CLINICS

COMMITTEE

P. C. Lowrey, Chairman, F. S. Cartwright and F. B. Vedder.

DETROIT DENTAL CLINIC CLUB

Full Denture Section

P. C. Lowery, Director

Detroit Group

"Diagnosis and Mouth Preparation"
By Charles Lane

"Preliminary Preparation for Correctable Impressions"
By W. I. Follis and H. E. Richardson

"Demonstration, on Patient, of Step Method Impression Technic"
By J. F. Turner

"Construction of Practical Working Casts"
By H. J. Shannon and George C. Carlson

"Staining and Other Means of Producing Natural Tooth Effects in Porcelain Teeth"
By E. L. Pilkington

"Reproduction of Wax Trial Dentures in Plastic and Metal Bases. Correction of Uncontrollable Discrepancies Occurring During Vulcanization"
By M. H. Miars and G. H. Fish

Ann Arbor Group

"Practical Selection and Arrangement of Teeth"
By R. H. Kingery
G. N. Cannon
J. B. Warren
L. C. Schultz

Surgical Section

Chalmers J. Lyons, Don M. Graham and Lloyd Rogers, Directors.

"Conduction Anesthesia Demonstration with Charts and Specimens"

C. Taylor Hall	Howard Jackson
John Shackelford	Don Bellinger
Evan Stewart	Carlton Fox
William Shannon	Clyde Chase (M.D.)

Orthodontia Section

Samuel J. Lewis, Director

"Occlusion: Its Biologic Significance"
By Stanley A. Mackenzie

"Diagnosis of Malocclusion and When to Treat"
By George R. Moore

"The Premature Loss of Deciduous Teeth and the Construction of Space Retainers"
By Frank S. Cartwright

"Orthodontic Band and Appliance Technic"
By F. R. Harding

"Treatment of Malocclusion, with Actual Cases"
By Ira A. Lehman

"Use of the Radiogram in Orthodontic Practice"
By Breyton D. Jones

"Nervous Habits and Their Relation to Malocclusion"
By Samuel J. Lewis

Ceramics Section

Arthur J. Norman, Director

I "The Porcelain Inlay"
By G. William King.....Detroit
A. J. Hall.....Ann Arbor

II 1. "Comparison and Selection of the Various Porcelain Bodies as to (a) Fusing point. (b) Color. (c) Texture. 2. Use and Care of Porcelain Furnace and Pyrometer; 3. Use of Stains"
By Don S. Graham and Paul S. Crosby .....Detroit

III "Anterior Jacket Crowns on Vital and Pulpless Teeth"
By Walter R. Priest and Anthony F. Sommers.....Detroit

IV 1. "Posterior Jacket Crowns on Vital and Pulpless Teeth"
2. "Use of Continuous Gum Bodies as a Substitute for Gold or Vulcanite in Partial Denture Cases"
By Roy G. Hayward and Arthur J. Norman.....Detroit

Crown and Bridge Section

O. C. Applegate, Director

"Review of Fixed-Bridge Prosthesis"
By O. C. Applegate

"Diagnosis"
By H. T. Wood

"Radiographic Evidence"
By H. H. Jackson

"Cavity Preparations for Bridge Abutments. The Indirect Method for Construction of Attachment Pieces"
By F. J. Bauman

"Types of Anchorage for Vital Teeth"
By H. M. Kyprie

"Full Crown Construction"
By O. M. Strong

"Transfer of Abutment-Pieces from Mouth to Occluded Models, Pontic Construction"
By C. J. Marcinkiewicz

"Assembling, Soldering, Heat-Treatment and Finishing"
By W. M. Bullock

"Cementation, Correction of Occlusal Relationship, Instructions to Patient as to Care of Bridge and Future Attention by Dentist"
By W. H. Elliot

Removable Restorations

Edward B. Spalding, Director

"Principle of Function and Method of Construction"
By Raymond L. Girardot
Norbert D. Kulsavage
Edward B. Spalding

Book-Cadillac Hotel, Detroit, Mich.

Pulpless Tooth Section

John H. Longe, Director

"Diagnosis and Radiography"
By Gerald E. Madison
George W. Christiansen
Frederick W. Dean

"Therapeutics"
By Fletcher R. Jackson
A. R. Munn
A. C. Thompson
Frederick R. Solmes

"Operative Technic"
By John R. Pear
Earl C. Barkley
J. S. VanValkenburg
David Seligson

"Root Filling"
By Louis Braun
Leo A. Cadarette
Harold S. Slocum
Robert J. Hamilton
Kenneth R. Gibson

The Chalmers J. Lyons Club

Chief ..... Chalmers J. Lyons
President ..... William A. Cook
Vice-President ..... J. Orton Goodsell, Jr.
Secretary-Treasurer ..... G. R. Maitland

"Treatment of Edentulous Jaw Fractures"
By J. Orton Goodsell, Jr.

"Use of Roentgen Ray in Oral Surgery"
By Joe J. Tolan

"Osseous Ankylosis of the Temporomandibular Joint"
By James O. Beavis

"Surgical Treatment of Oral Perforations of the Maxillary Sinus"
By Vernon H. Eman and G. R. Maitland

"Cleft Palate and Cleft Lip" (Clinic, University Hospital, Ann Arbor)
By Chalmers J. Lyons and L. F. Hill

"Alveolotomy and Its Uses"
By Don H. Bellinger and J. L. Lundberg

"Removal of Fracture Roots"
By William A. Cook

"Curettement, Incision and Suturing"
By C. Taylor Hall

"Maxillary and Mandibular Fractures"
By Don H. Graham

Detroit Pedodontic Study Club

Table 1—"Model Presentation of Normal and Abnormal Deciduous Mouths"
Section I—E. Seitz. Section II—S. D. Harris

Table 2—"Treatment and Care of Vital Deciduous Teeth"
Section I—K. R. Gibson. Section II—E. Swift.

Table 3—"Treatment and Care of Pulpless Deciduous Teeth"
Section I—W. C. McBride. Section II—R. J. Vaughan

Table 4—"Space Retention and Prophylaxis"
Section I—E. James. Section II—William H. McCracken

General Clinics

"Prevention and Control of Dental Caries by the Control of Bacillus Acidophilus Overgrowths in the Mouth"
By Russell W. Bunting ..... Ann Arbor
Dorothy G. Hard ..... Ann Arbor
William H. McCraken ..... Detroit

"Cast Inlay"
By John J. Travis, Robert K. Brown and Paul H. Jeserich ..... Ann Arbor

"Inlay Bridges"
By F. B. Vedder ..... Ann Arbor
C. T. Nelson ..... Grand Rapids
E. A. Honey ..... Kalamazoo

"Fundamentals of Success in Root Canal Surgery, as a Permanent Root Canal Filling With and Without Resection"
By U. G. Rickert, R. F. Sommers, H. W. Shields and M. D. McCoy ..... Ann Arbor

"Wrought Clasps in Partial Denture Construction"
By O. E. Getts ..... Lansing

"Surgery. The Effect of the Cranial Nerve Connections and Distribution of the Trigeminal Nerve on Success or Failure in Local Anesthesia"
By Don C. Lyons ..... Jackson

"Occlusion in Full Denture Construction"
By C. J. Siddall ..... Kalamazoo

"Technic of Exposure, Developing, Fixing and Reading of Roentgen Rays"
By W. R. McInnes ..... Alma

"A Practical Clinic on the Baking of Porcelain Pontics"
By E. J. Garlock ..... Lansing

"Cleft Palate Prosthesis, with Special Cases"
By E. L. Whitman ..... Ann Arbor

"Preventive Dentistry in General Practice"
By Harold S. Slocum.....Detroit

"The Use of Porcelain and Mineral Oxid Stains to Produce Natural Tooth Effects as to Both Form and Color"
By E. L. Pilkington.....Detroit

"Diagnosis and Surgery of Cysts of Maxilla and Mandible"
By Martin L. DeBats.....Detroit

"Logic, Esthetic and Basic Principles Applied to Surgical Prosthesis. Technic for Removal of Roots from Antrum"
By George W. Christiansen.....Detroit

"Plaster Records Using Porter Model Former"
By Harry L. Hosmer.....Detroit

"Removable Restorations"
By Wilbert J. Whitman.....Detroit

"Bridge Abutment Preparations"
By R. L. Donaldson.....Detroit

"Cysts"
By James H. Howell.....Detroit

"Three-Quarter Veneer Crowns"
By Creighton L. Lane.....Detroit

"The Orthodontist Help"
By Howard L. Jones.....Detroit

"Porcelain Jacket Crown"
By C. G. Parker.....Detroit

"Full Denture Construction"
By James C. Shanks.....Detroit

"Continuous Gum Porcelain and Its Uses in Removable Restorations"
By J. Melville Thompson.....Detroit

"Full Denture Impressions"
By R. J. Von Tick.....Detroit

"Clasp Attachments in Removable Bridgework"
By Arthur D. Robinson.....Detroit

"Some Physical Aspects of the Functions of the Occlusal Surfaces. Determining Incline Plane Relationships and Exposure of Triangular Ridge"
By Alex S. Diack.....Detroit

SURGICAL CLINICS

"Surgical Eradication of Pyorrheal Lesions"
By A. W. Ward.....San Francisco, Calif.

"Surgery as Indicated in the Treatment of Periodontoclasia"
By R. H. Belanquie.....San Francisco, Calif.

"Cleft Palate and Cleft Lip"
By Chalmers J. Lyons
University of Michigan Hospital, Ann Arbor

"Reduction and Treatment of Fractures"
By Lloyd Rodgers and C. Taylor Hall
General Hospital, Detroit

"Oral and Plastic Surgery, Single Cleft Lip Operation"
By Claire L. Straith
Harper Hospital Amphitheatre, Detroit

"Review of Hospital Cases from an Oral Surgery Standpoint"
By William A. Cook and Don H. Bellinger
Ford Hospital, Detroit

THE DETROIT SESSION

FIFTH INTERNATIONAL MOUTH HYGIENE LUNCHEON

(Dining Room, Fourteenth Floor, General Motors Building)

12:10 to 2 p. m.

A mouth hygiene luncheon under the direction of the Committee on Mouth Hygiene and Public Instruction of the American Dental Association will be held in the Dining Room, Fourteenth floor of the General Motors Building, Oct. 26, 1927, at 12:05 p. m.

Tickets, at $1.00 each, may be obtained at the Registration Booth and at the Mouth Hygiene Booth, located in the Health Exhibit Section. (John H. Longe, Local Chairman, Mouth Hygiene Luncheon.) A specal invitation is extended to all those interested in public health. Each speaker will be limited to seven minutes.

WILLIAM R. WRIGHT, *Chairman,*

Committee on Mouth Hygiene and Public Instruction.

Henry L. Banzhaf, Chairman ..... Milwaukee, Wis.

"Fads and Fakes"
By Morris Fishbein (M.D.) ..... Chicago, Ill.
Editor of *The Journal of the American Medical Association.*

"High Points in the Educational Aspect of the Cancer Problem"
By Joseph C. Bloodgood (M.D.) ..... Baltimore, Md.

"The Place of Dental Health in a Public Health Program"
By Guy L. Kiefer (M.D.) ..... Lansing, Mich.
State Health Commissioner, Michigan

"Newer Aspects of the Nutritional Problem"
By Sherman L. Davis (Ph.D.) ..... Bloomington, Ind.

"The Eastman Dental Dispensary Program for London"
By Harvey J. Burkhart Rochester, N. Y.
Director, Rochester Dental Dispensary

MOTION PICTURE PROGRAM

(Motion Picture Hall, Auditorium J)

OFFICERS

Otto U. King, General Chairman ..... Chicago, Ill.

Evelyn C. Schmidt, Acting Chairman ..... Chicago, Ill.
(Director, Department of Dental Health Education, American Dental Association)

George W. Christiansen, Local Chairman ..... Detroit, Mich.

This program will be presented Monday, Tuesday and Wednesday, October 24-26, both morning and afternoon, and on Thursday, October 27, until noon. From six to eight different films will be shown each half day, and in all twenty different films will be presented. Details of the program will be published in the official program of the Session. Any changes in the schedule of films will be announced on the bulletin board at the Motion Picture Hall.

HEALTH EXHIBITS

Otto U. King, Chairman ..... Chicago, Ill.
Emerson R. Sausser ..... Philadelphia, Pa.
A. C. Thompson, Local Chairman ..... Detroit, Mich.
Edgar James ..... Detroit, Mich.
Harold Slocum ..... Detroit, Mich.
Robert Vaughan ..... Detroit, Mich.
Kenneth Gibson ..... Detroit, Mich.
Evelyn C. Schmidt ..... Chicago, Ill.

The Dental Health Exhibit is to be divided into various groups, each representing a phase of the dental problem. The chairmen, workers in their special field, have organized their corresponding groups, and are presenting their exhibits with the problem in view, rather than any particular association or individual. For example, all states carrying on dental health work will be represented under "States' Activities;" all of the training schools for dental hygienists are contributing to a composite exhibit; dental services and policies in industry will be represented

by one exhibit developed from contributions from several companies, etc.

I. American Dental Hygienists Associations
Helen N. Blake, Chairman, Milford, Conn.

II. Hospitals and Dispensary Service
William D. Tracy, Chairman, New York City.
Clare Terwilliger, New York City.

III. Industrial Dental Service
Thaddeus P. Hyatt, Chairman, New York City.
Arthur M. Hunter, New York City.
I. R. Humphrey, International Harvester Co., Chicago, Ill.
W. L. Rhodes, Endicott-Johnson Corp., Johnson City, N. Y.
E. S. Arnold, The Travelers Insurance Co., Hartford, Conn.

IV. Institutional Dental Service
Emerson R. Sausser, Chairman, Philadelphia, Pa.
Harold DeWitt Cross, Boston, Mass.

V. Official and Nonofficial Health Agencies
Evelyn C. Schmidt, Chairman, Chicago, Ill.

VI. Public School Dental Service
Alfred C. Fones, Bridgeport, Conn.

VII. Rural Service
Edward F. Sullivan, Chairman, Boston, Mass.

VIII. States' Activities
William R. Davis, Chairman, Lansing, Mich.
Gladys Eyrich, Jackson, Miss.

IX. Training Schools for Dental Hygienists
Anna V. Hughes, Chairman, New York City.
Charlotte Klatt, Philadelphia, Pa.
Blanche Downie, Philadelphia, Pa.

REPORTS ON THE SIXTY-NINTH ANNUAL SESSION

REPORT OF THE GENERAL CHAIRMAN

For the first time in fifty years, Detroit is to have the honor of entertaining the dentists of America in annual convention. That this is no small honor is the feeling of the dentists of the "Automobile City" and the state of Michigan, and as a result they have banded together in harmonious action to convince each and every visitor during our October meeting that Detroit is the most hospitable city in this United States and that the state of Michigan offers a greater yield of true brotherly love to the square acre than any other state in the Union.

If you have not visited the city with the title "Beautiful and Dynamic," you should arrange to make the trip, particularly in the month of October. It will be one of pleasure and education, full of delightful experiences, furnishing memories worth while.

Beautiful and dynamic—those two words not only challenge the imagination, but also vividly portray the two aspects of the city's personality: The first by its scenic beauty, rich in gifts of Nature, and the second its position as the world's great workshop, with the hum of industry bringing a material prosperity that is reflected in the contentment of the community.

Detroit has attained an enviable reputation as a convention city, not only because of the ample facilities for staging the programs and housing the delegates in attendance, but also because of its genial hospitality and the warm hearted welcome which her citizens in general extend to the stranger within the gates.

In a recent report of the work of the Local Committee on Arrangements, it was stated that, as a result of the energetic qualities and executive training of the subcommittee chairmen, it was impossible for the chairman of the committee to find details that had not been attended to. This is direct evidence of the fact that you are going to find a well balanced and capably manned local committee to greet your arrival.

The assistance rendered by Dr. King, the Secretary and Business Manager of our national organization, has been of a helpful and stimulating nature. It is with confidence that we, as a committee, make the following announcements, and predict for you a pleasant and profitable visit to our city.

CHARLES LANE,
Chairman.

COMMITTEE ON LOCAL ARRANGEMENTS AMERICAN DENTAL ASSOCIATION CONVENTION, DETROIT, MICHIGAN, OCT. 24-28, 1927

Harry T. Wood — Reception & Transportation
R. E. Patterson — Commercial Exhibits
E. O. Gillespie — Information & Registration
A. C. Thompson — Health Exhibits
William T. Burke — Halls & Hotels
Patrick J. O'Reilly — Publicity
O. W. White — Entertainment
Charles Lane — Chairman
W. F. Northrup — Secretary-Treasurer
Edgar L. Giffen — Clinics

REGISTRATION AND INFORMATION

Without seeming to overestimate or overvalue the importance of the work of the Committee on Registration and Information, we do feel that the comfort of the guests at the coming meeting—the feeling of being at home, and the ease and expeditious movements of the members from place to place, will depend in a large degree on the completeness of your committee's program for furnishing guests promptly with all sorts of desirable information, and, through complete and efficient arrangements, making a quick and easy registration possible.

To this end, the personnel is being chosen with special care. These men will be charged particularly with necessary preparations and arrangements preceding the meeting. Depots and hotels will be supplied with booths carrying detailed information for all who desire it. In addition, every dentist in Michigan affiliated with organized dentistry will consider himself a member of this committee and will see to it that the stranger is made welcome.

Appropriate badges and buttons will be selected for the various groups who will be present, and registration arrangements will be as nearly complete as possible, so that there shall be neither confusion nor delay.

To receive, register and start off rightly 12,000 members and visitors will be our responsibility.

E. O. GILLESPIE

HALLS AND HOTELS

It was not difficult for this committee to find suitable convention halls in Detroit. But it was no small matter to select that one which, in our opinion, would best serve the interests of the dentists in attendance, and the exhibitors at one and the same time.

Our choice finally settled on the General Motors Building, the largest office building of its kind in the world, as our meeting place. All clinics, papers and technical demonstrations will be on the same floor as the exhibitors. Cafeteria service within the building of sufficient proportions to serve our entire attendance within one hour is an added attraction. It will not be necessary to leave the convention headquarters from the time the meetings open in the morning until closing time in the afternoon.

Detroit has built more than one hotel a month during the past three years and can easily care for more than ten times the anticipated attendance.

The Book-Cadillac Hotel has been designated as the headquarters hotel, and the meetings of the House of Delegates will be held in the ballroom.

The cooperation we are receiving from all the hotels and the Hotel Men's Association is such as to convince us that your visit next October will be one of comfort and gratification.

WILLIAM T. BURKE

RECEPTION AND TRANSPORTATION

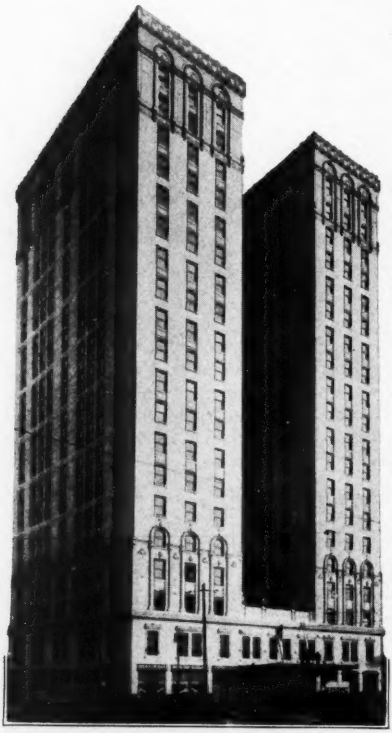
The committee that meets you, the committee that greets you, feels a special sense of security in executing its obligations for this meeting. The inner consciousness of comfort, the feeling of being at home, so often expressed by travelers who visit our city for the first time, brings to us a confidence that you are coming with happy anticipation and that you will leave feeling that your visit has been worth while.

As an example of the little things we have worked out: Arrangements have been made with the Detroit Motorbus Company for the issuance of a five day transportation ticket good over all their Detroit lines, at a total cost of $3.00. This not only will enable the visitor to ride to and from the convention hall, but will supply the means of travel to many points of interest throughout the city.

The General Motors Building is not within practical walking distance from the hotel district as the distance is three miles. However, with the Woodward Avenue street car, which maintains splendid service with a two minute schedule and fifteen minute running time; the city busses on Woodward Avenue with the same schedule; the Checker Cab Company, with a large fleet, a ten-minute running time and a fare of 80 cents to $1.00 for from one to five passengers, and the official busses before mentioned, those in attendance should find this portion of their needs well taken care of.

For those who wish to motor to the city, provision has been made with the Detroit Garages, Incorporated, to house the cars of our vistors at a cost of $7.00 for the week. In addition, there are numerous out-door parking lots, with varying prices for day to day storage.

HARRY WOOD



Hotel Barlum, Detroit, Mich.

ENTERTAINMENT

Members of the Michigan State Dental Society and the First District Dental Society are assisting the Entertainment Committee in every way to make your trip to Detroit one long to be remembered.

Those who attend the national meeting will find an entertainment program arranged so as not to interfere with the regular program meetings.

Starting Monday noon, the officers of the American Dental Association, the Trustees, and the members of the House of Delegates will be invited to attend a luncheon as guests of the Michigan State Dental Society.

At 10 o'clock, on Tuesday, Governor Fred W. Green, Mayor John Smith, of Detroit, and others will deliver addresses of welcome. At 12:15 o'clock, in the Grand Ballroom of the Book-Cadillac Hotel, a reception and luncheon will be tendered Dr. Banzhaf, President of the American Dental Association; Mrs. Banzhaf; Dr. Volland, President-Elect, and Mrs. Volland, by the First District Dental Society, of Detroit. Invitations to this function will probably have to be restricted to those dentists who are accompanied by their wives or by guests.

Thursday night, in the Grand Ballroom of the Book-Cadillac Hotel, will be staged a theatrical presentation of American Dentistry as represented by the American Dental Association, produced by the Detroit Dental Clinic Club under the direction of the Preventive Dentistry Section, Grace Rogers Spalding, director.

Following this feature, arrangements are being made to hold a grand ball and bridge party. The entire ballroom floor of the Book-Cadillac Hotel, consisting of three large ballrooms and several parlors, has been reserved for this function.

As regards entertainment of women guests, a parlor and the Venetian Lounge of the Book-Cadillac Hotel will be at their disposal. Women guests are requested to use these headquarters and ask for information regarding sight-seeing tours and shopping tours and anything that will add to their comfort and pleasure while in the city.

O. W. WHITE

HEALTH EXHIBITS

The committee is divided into the following groups: Harold S. Slocum, Kenneth R. Gibson, Edgar James and Robert J. Vaughn have charge of the local arrangements of the Health Exhibit. They are arranging the details of the hall as to decorations, etc.

John H. Longe has the noon luncheon in charge.

Elsie C. Seitz has in charge the auditorum talks for high schools and colleges and has already made arrangements for speakers for several high schools. She also has in charge speakers for the noontide women's clubs.

Herbert E. Arndt has in charge the men's noontide club speakers, as well as radio talkers for the week of the convention.

A. C. THOMPSON

CLINICS

The activities of this committee to date comprise the location of the various section auditoriums and halls and the spaces for general clinics; also the placing of the various sections in those rooms and the clinics in the spaces. The members of the committee have been selected, and the instructions for construction of various partitions have been given to the chairman, who has charge of building them.

When the list of essayists and clinicians is completed, their positions will be assigned.

Plans call for seven auditoriums and two halls, which have been designated as Auditoriums A, B, D, E, G, H, I, and Halls C and F. The auditoriums will accommodate about 200 each, the halls, about 100 each.

The seven sections have been assigned as follows: A, operative dentistry; B, full denture; D, partial denture; E, oral surgery; G, orthodontia and periodontia; H, preventive dentistry and mouth hygiene; I, research.

The space which will be occupied by the Health Exhibit until Thursday noon will be occupied by the general clinics on Thursday afternoon and all day Friday. Friday afternoon has been set aside for Michigan day.

Following is a list of the members of the Clinic Committee: W. J. Whiteman, 1529 David Whitney Bldg.; R. L. Girardot, 1411 Stroh Bldg.; William H. Waller, 808 Stroh Bldg.; Walter M. Bullock, 9101 Hamilton Ave.; Frank J. Bauman, 12897 Woodward Ave.; Arthur Deyoe, 6500 Woodward Ave.; A. P. Pilides, 613 David Whitney Bldg.; John R. Pear, 7702 W. Jefferson Ave., and E. L. Giffen, Chairman, 7-262 General Motors Bldg.

E. L. GIFFEN

EXHIBITS

The Local Committee is giving every consideration to the convenience, comfort and welfare of our exhibitors. It has become quite generally admitted that a state or national convention that is to attain any degree of magnitude must incorporate the exhibitors as an integral part of their organization. With this thought in mind, the Committee sought out and secured a convention headquarters that amply provides for the staging of this big meeting under one roof and on one floor.

Under the arrangements which have been provided, the manufacturers and dealers may reach the visiting dentists with their message without any great inconvenience to either party. Working under a contract made through the Central Office, the Griffin Decorating Company will assume responsibility for the building of booths and partitions; decorations; lighting and heating; special wiring; building information booths; printing a daily program; building and furnishing lounge room; furnishing extra tables and chairs; all special carpenter and electrical work; printing signs, and furnishing private detectives, watchmen (both day and night), porters, matrons, special doormen, cleaning crew, etc. This company will also take charge of all freight, express, cartage and storage of goods if necessary, and insure delivery at a specified time.

A definite plan whereby the exhibitor, his assistants and necessary attendants will be registered for admittance has been perfected. No applicant for admission to the exhibit hall or convention floor will gain entrance unless so registered.

On behalf of the Local Committee and the loyal dentists of Detroit and Michigan, I extend greetings, and a welcome to what has every indication of being the greatest session the American Dental Association has ever staged.

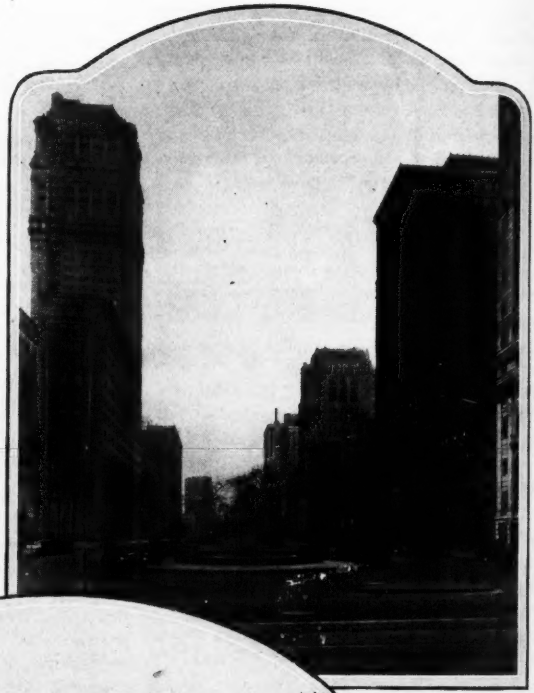
R. E. PATTERSON

ANNOUNCEMENTS

DELTA SIGMA DELTA FRATERNITY

The forty-third annual meeting of the Supreme Chapter of Delta Sigma Delta Fraternity will be held in the Hotel Statler, Detroit, Monday, October 24. The first session

Street
Scene,
Detroit



Belle Isle, Detroit, Mich.

will be held at 9:30 a. m., followed by an afternoon session immediately after luncheon. Initiatory exercises will be held during the afternoon session. Matters of importance to the fraternity will come up for action during the morning and afternoon sessions, and it is hoped that there will be a large attendance. To avoid delay in registration, present your membership card. Those expecting to attend should notify the chairman of the Committee on Hotels and Reservations, Louis Braum, 717 David Whitney Bldg., Detroit. For general information regarding the meeting, other than for hotel reservations, write to G. R. Maitland, 1047 David Whitney Bldg., Detroit.

By order of the Supreme Chapter

F. WADE LA RUE, *Supreme Grand Master*,
Medical Arts Bldg.,
Indianapolis, Ind.

R. HAMILL D. SWING, *Supreme Scribe*,
Elrae Bldg.,
Philadelphia, Pa.

XI PSI PHI FRATERNITY, SUPREME CHAPTER

The Supreme Chapter, Xi Psi Phi, will hold its biennial meeting, October 21-22, at the Hotel Tuller, Detroit, Mich. A banquet will be held, Monday, October 24. All members of the fraternity are welcome.

H. B. PINNEY, *Sec'y-Treas.*,
108 N. State St.,
Chicago, Ill.

XI PSI PHI FRATERNITY, NATIONAL ALUMNI CHAPTER

The National Alumni Chapter, Xi Psi Phi, will hold its annual meeting, October 24, at the Hotel Tuller, Detroit, Mich.

J. H. BILLINGS, *President*,
G. W. HILLIAS, *Sec'y-Treas.*,
Bryant Bldg.,
Kansas City, Mo.

FEDERATION OF AMERICAN WOMEN DENTISTS

The sixth annual meeting of the Federation of American Women Dentists will be held in Detroit, Mich., October 24.

GRACE ROGERS SPALDING, *President*,
423 Maple Ave., West,
Birmingham, Mich.

MARY B. MEADE, *Secretary*,
Carmi, Ill.

AMERICAN DENTAL ASSISTANTS ASSOCIATION

It is the desire of the officers of the American Dental Assistants Association to communicate with every dental assistants' organization throughout the country, in order that dental assistants in various parts of the country may be brought in contact with the society in their respective locality. A number of inquiries are received for such information. It is also desired to send to the various societies literature and other data of interest. The American Dental Assistants Association wishes to cooperate in every possible manner with all dental assistants' societies, and in this spirit of cooperation and friendship, solicits the interest of the officers of the various organizations. Its object is strictly educational and its purpose is to aid all dental assistants to render better service to the dental profession. Its watchwords are education, efficiency, loyalty, service.

A cordial invitation is extended to the non-affiliated societies to attend the third annual meeting of the American Dental Assistants Association, at Detroit, Mich., October 25, 26, 27, at the Hotel Savoy. All dental assistants will be welcome. Interesting programs, clinics, luncheon, etc. Come and make the acquaintance of others who are in the same field of activity. The inspiration derived will justify the effort.

JULIETTE A. SOUTHARD, *President*,
174 West 96th Street,
New York City.

MAUDE SHARPE, *General Secretary*,
Suite 1202, 8 West 40th Street,
New York City.

AMERICAN DENTAL HYGIENISTS ASSOCIATION

The next meeting of the American Dental Hygienists Association will be held in conjunction with the American Dental Association in Detroit, Mich., October 24-28.

ETHEL F. RICE, *Secretary*,
721 N. University Ave.,
Ann Arbor, Mich.

TRANSPORTATION TO THE ANNUAL SESSION OF THE A. D. A., DETROIT

An Identification Certificate will be sent to each member of the American Dental Association, approximately one month in advance of the meeting. When properly filled out and presented to the local railway agent, it will authorize him to sell a round trip ticket to the member for himself and dependent members of his family, at one and one-half fares. Selling dates for these tickets will be October 15-17-18-19-22-24 and 25, with return limit, November 3.

D. C. BACON, *Chairman*,
Transportation Committee.

AMERICAN DENTAL TRAPSHOOTERS LEAGUE

The American Dental Trapshooters League will hold its fifth annual tournament at Detroit during the annual meeting of the American Dental Association, October 24-28. All ethical dentists who are interested in trapshooting are cordially invited to attend. A number of cups and valuable prizes will be competed for, and it is the hope of the league to hold the biggest shoot in its history.

T. L. PEPPERLING, *President*,
St. Louis, Mo.

C. W. MILLS, *Secretary*,
Chillicothe, Ohio.

DIRECTORY OF TECHNICAL EXHIBITORS

The Abbott Laboratories, North Chicago, Ill.

The Alkalol Co., 141 Washington St., Taunton, Mass.

The American Cabinet Co., Two Rivers, Wis.

The W. V-B. Ames Co., Fremont, Ohio.

The Anacin Company, 30 E. Kinzie St., Chicago, Ill.

The Antidolor Mfg. Co., Springville, N. Y.

Archer Mfg. Co., Inc., Rochester, N. Y.

The Barkmeyer Electrical Laboratory, 549 W. Washington Blvd., Chicago, Ill.

The Bayer Company, Inc., 117 Hudson St., New York City.

Becton, Dickinson & Co., Rutherford, N. J.

The Berry Dental Laboratory Co., Equitable Bldg., St. Louis, Mo.

Frank S. Betz Company, Hammond, Ind.

Blue Island Specialty Co., Inc., 282 Western Ave., Blue Island, Ill.

Henry P. Boos, 608 Nicolett Ave., Minneapolis, Minn.

Harry J. Bosworth Co., 341 E. Ohio St., Chicago, Ill.

Bristol-Myers Co., 75 West St., New York City.

Buck X-Ograph Co., 6629 Olive St., St. Louis, Mo.

Buffalo Dental Mfg. Co., 587 Main St., Buffalo, N. Y.

Burdick Cabinet Co., Milton, Wis.

Burns Dental Casting Machine Co., Inc., 88 State St., Flushing, N. Y.

Dr. John O. Butler, 1180 E. 63rd St., Chicago, Ill.

Cameron's Surgical Specialty Co., 666 W. Division St., Chicago, Ill.

Castle Wilmot Co., 1155 University Ave., Rochester, N. Y.

The L. D. Caulk Company, Milford Del.

The Cleveland Dental Mfg. Co., 3307 Scranton Road, S.W., Cleveland, Ohio.

Coe Laboratories, 25 E. Washington St., Chicago, Ill.

Colgate & Company, 581 Fifth Ave., New York City.

Columbia Dental and X-Ray Corporation, 131 E. 23rd St., New York City.

Columbus Dental Mfg. Co., Wager & Jackson Sts., Columbus, Ohio.

P. N. Condit, 120 Boylston St., Boston, Mass.

Cook Laboratories, Inc., 536 Lake Shore Drive, Chicago, Ill.

Corega Chemical Co., 208 St. Clair Ave., Cleveland, Ohio.

Crescent Dental Mfg. Co., 1839 So. Crawford Ave., Chicago, Ill.

Thomas J. Dee & Co., 5 S. Wabash Ave., Chicago, Ill.

Dental Items of Interest Publishing Company, Inc., 2921 Atlantic Ave., Brooklyn, N. Y.

Dental Products Co., 7512 Greenwood Ave., Chicago, Ill.

Dental Specialty Co., 1638 California St., Denver, Colo.

The Dentists' Supply Co., 220 W. 42nd St., New York City.

The Denver Chemical Mfg. Co., 163 Varick St., New York City.

Detroit Dental Manufacturing Co., 6081-12th St., Detroit, Mich.

Detroit Porcelain Laboratory, 607 Stroh Bldg., Detroit, Mich.

The DeVilbiss Co., 300 Phillips Ave., Toledo, Ohio.

The Dresch Laboratories Co., Nasby Bldg., Toledo, Ohio.

August E. Drucker Co., 2226 Bush St., San Francisco, Calif.

Eastman Kodak Co., 343 State St., Rochester, N. Y.

Ehrhardt & Co., 179 N. Michigan Ave., Chicago, Ill.

Electro Dental Manufacturing Co., 33rd & Arch Sts., Philadelphia, Pa.

H. Fischer & Company, Inc., 792 Lexington Ave., New York City.

Friedman Specialty Co., 25 E. Washington St., Chicago, Ill.

Garhart Dental Specialty Co., Hill Bldg., Union Sq., Boston, Mass.

The Grant Dental Mfg. Co., 403 Baltimore W., Cor. Cass St., Detroit, Mich.

Hanau Engineering Co., 951 W. Ferry St., Buffalo, N. Y.

Hanovia Chemical & Mfg. Co., Chestnut St. & N. J. R. R. Ave., Newark, N. J.

The Harvard Co., 2206—13th St., Canton, Ohio.

Jay E. Healey, 95—38th St., Brooklyn, N. Y.

The Heidbrink Company, 2633—4th St., Minneapolis, Minn.

The Hoffman-La Roche Chemical Works, 17 Cliff St., New York City.

The Hofschneider Corporation, 848 Jay St., Rochester, N. Y.

John Hood Company, 178 Tremont Ave., Boston, Mass.

Hoover & Strong, Inc., 119 W. Tupper St., Buffalo, N. Y.

Horlick's Malted Milk Corp., Racine, Wis.

The Hu-Friedy Mfg. Co., 3118 N. Rockwell St., Chicago, Ill.

Ideal Tooth Incorporated, 90 Hamilton St., Cambridge, Mass.

J. W. Ivory, 310 N. 16th St., Philadelphia, Pa.

J. F. Jelenko & Co., 136 W. 52nd St., New York City.

Johnson & Johnson, New Brunswick, N. J.

H. D. Justi & Son, 32nd & Spring Garden Sts., Philadelphia, Pa.

J. H. Kaplan, 25 E. Washington St., Chicago, Ill.

J. E. Kennedy Dental Laboratory, Battle Creek, Mich.

King's Specialty Co., 135 E. Washington St., Fort Wayne, Ind.

P. A. Kirsten Dental Laboratory, David Whitney Bldg., Detroit, Mich.

The Kolynos Company, 130 Bristol St., New Haven, Conn.

Kress & Owen, 361 Pearl St., New York City.

Lambert Pharmacal Co., Locust and 21st Sts., St. Louis, Mo.

Henry G. Landberg Sales Co., 174 West 3rd St., St. Paul, Minn.

H. R. Lathrop & Co., Inc., 110 Beekman St., New York City.

Lavoris Chemical Company, 918 N. Third St., Minneapolis, Minn.

Lea & Febiger, 600 S. Washington Sq., Philadelphia, Pa.

L. LeLong & Bro., Inc., 345 Halsey St., Newark, N. J.

Lincoln Dental Mfg. Co., 1726 Sansom St., Philadelphia, Pa.

Lochhead Laboratories, Inc., 115 W. 45th St., New York City.

The McCaskey Register Co., S. Union Ave., Alliance, Ohio.

The Mechanical Appliances Co., 808 Pershing Sq. Bldg., Los Angeles, Calif.

The Medical Protective Co., 35 E. Wacker Drive, Chicago, Ill.

The Wm. S. Merrell Co., 5th & Pike, Cincinnati, Ohio.

H. A. Metz Laboratories, Inc., 122 Hudson St., New York City.

E. C. Miller Co., 2115 W. 4th St., Williamsport, Pa.

Mizzy, Inc., 105 E. 16th St., New York City.

Modern Dental Specialties, 5 S. Wabash Ave., Chicago, Ill.

The J. M. Ney Company, Elm & West Sts., Hartford, Conn.

Novocol Chemical Mfg. Co., Inc., 2923 Atlantic Ave., Brooklyn, N. Y.

Odontex Products Corporation, 315 Fifth Ave., New York City.

Ohio Chemical & Mfg. Co., 1177 Marquette St., Cleveland, Ohio.

The E. L. Patch Co., Stoneham 80, Boston, Mass.

M. F. Patterson Dental Supply Co., 406 Sixth Ave. So., Minneapolis, Minn.

The Pelton & Crane Co., 632 Harper Ave., Detroit, Mich.

The Pepsodent Company, 1104 S. Wabash Ave., Chicago, Ill.

Charles H. Phillips Chemical Co., 117 Hudson St., New York City.

Poloris Company, Inc., 79 E. 130th St., New York City.

Postum Cereal Co., Inc., Postum Block, New York City.

Professional Underwriters Corp., 154 Louis St., Grand Rapids, Mich.

Pro-phy-lac-tic Brush Co., Florence, Mass.

The Ransom & Randolph Co., Toledo, Ohio.

Ritter Dental Manufacturing Co., Inc., 404 West Ave., Rochester, N. Y.

The Silv-o-Dent Co., 17th & Alberta Sts., Portland, Ore.

Lee S. Smith & Son Mfg. Co., Keenan Bldg., Pittsburgh, Pa.

Specialty Mfg. Co., 39 Front St., Brooklyn, N. Y.

Spyco Smelting & Refining Co., 51 S. Third St., Minneapolis, Minn.

E. R. Squibb & Son, 80 Beekman St., New York City.

Frederick Stearns & Co., Detroit, Mich.

Sterile Products Co., Spreckels Bldg., San Diego, Calif.

I. Stern & Co., 105 E. 16th St., New York City.

Szabo & Beer, 30 East 14th St., New York City.

Toledo Technical Appliance Co., 2228 Ashland Ave., Toledo, Ohio.

Universal Dental Co., Brown at 48th St., Philadelphia, Pa.

Vernon Brothers & Company, 214 Stanwix St., Pittsburgh, Pa.

Victor X-Ray Corporation, 2012 W. Jackson Blvd., Chicago, Ill.

The S. S. White Dental Mfg. Co., 211 S. 12th St., Philadelphia, Pa.

H. B. Wiggin's Sons Co., Bloomfield, N. J.

The Williams Gold Refining Co., 2978 Main St., Buffalo, N. Y.

Wilmot Castle Co., 1155 University Ave., Rochester, N. Y.

John H. Wood Company, 126 Market St., Philadelphia, Pa.

The General Motors Building, which will house the great industrial exhibit of manufacturers and dealers.

The General Motors Building is probably the largest office building in the world and affords ideal facilities for the great dental convention.

The opening meeting will be held in the commodious auditorium, and the registration headquarters, all section meetings, clinics, scientific and health exhibits, motion picture hall, etc., will be on the same floor and practically surrounding the technical exhibit space. It will be necessary to pass through the exhibit space to reach six of the section auditoriums, which will be in almost constant use.

Exhibitors will have five full days to display and take orders for their products. Restaurants and cafeterias in the General Motors Building can accommodate the large attendance anticipated.

A directory of exhibitors is published herewith and will be published in the official program and the September Issue of *Dental News*.

HENRY L. BANZHAF, *President*
OTTO U. KING, *General Secretary*

AMERICAN DENTAL ASSOCIATION

Detroit, Mich. Oct. 24-28, 1927.

HOTEL RESERVATIONS

In securing hotel reservations for the 1927 Session, consult the hotel rate-sheet and fill out the blank application below. Mail it immediately to the hotel that you wish to patronize. The hotel will then advise you of the reservation which they make for you.

WILLIAM T. BURKE,
Chairman,
Halls and Hotels,
507 Fine Arts Bldg.,
Detroit, Mich.

Keep this reminder of your reservation.

Hotel selected.....

No. of Rooms.....

No. of Persons.....

Date of reservation.....1927.

Detach here and keep the above for reference.

MAIL THIS APPLICATION DIRECT TO HOTEL

HOTEL RESERVATION

AMERICAN DENTAL ASSOCIATION, DETROIT, MICH., OCT. 24-28, 1927.

.....HOTEL .....1927.
Detroit, Mich.

Please reserve sleeping room accommodation noted below:

..... Room (s) with bath for.....people. Rate Desired $.....
(per day)

..... Room (s) without bath for.....people. Rate Desired $.....
(per day)

I hereby agree to pay for room described from morning of October ..... to October ..... unless cancellation is made by Oct. 1, 1927.

List of names and addresses who will occupy room with you.

Name ..... Address .....
Street, City and State.

Name ..... Address .....
Street, City and State.

Name ..... Address .....
Street, City and State.

HOTEL ROOM RATES—DETROIT

HOTEL	Rooms	WITH BATH		WITHOUT BATH	
		One Person	Two Persons	One Person	Two Persons
BOOK-CADILLAC Michigan and Washington Blvd.	1,200	$4.00	$6.00		
STATLER Grand Circus Park	1,000	3.00	5.00		
TULLER Grand Circus Park	800	2.50	5.00		
SAVOY Woodward and Adelaide	750	2.50	4.00		
DETROIT-LELAND Cass and Bagley	700	3.00	5.00		
BARLUM Cadillac Square and Bates	810	2.50	4.00		
FORT SHELBY Lafayette and First	393	3.00	4.50	$2.50	$3.50
FORT WAYNE Cass and Temple	300	2.50	5.00		
IMPERIAL 26 Peterboro	170	3.00	5.00		
MADISON-LENNOX Madison Ave.	300	2.50	4.00	2.00	3.00
NORTON Jefferson and Griswold	250	2.75	4.50	2.00	3.50
PALMETTO John R. and Hancock	324	3.50	5.00		
PRINCE EDWARD Windsor, Ontario, Canada	250	3.00	6.00		
ROYAL PALM 2305 Park Ave.	180	3.50	5.00		
STEVENSON 46 Davenport	207	2.50	4.00		
WEBSTER HALL (*Bachelor*) 111 Putnam	766	3.00		2.00	4.00
WOLVERINE Witherell and Elizabeth	500	2.50	5.00		
FAIRBAIRN Columbia and John R.	450	2.50	4.00	1.50	3.00
PARK AVENUE Park and Sproat	250	3.50	5.00		
PAUL REVERE 67 Sproat	360	2.50	3.50	2.00	3 00
PLAZA 166 Madison	100	2.50	3.50		
WARDELL APTS. 15 E. Kirby Ave.	165	Apts. $65.00 per month and up			

Medical and Dental News

California

Southern California Dentists Install Officers: The following officers have been elected for the ensuing year by the Southern California State Dental Association: president, C. C. Noble, Los Angeles; vice-president, G. B. Baird, Los Angeles; secretary, C. M. Alderson, Los Angeles; treasurer, Henry F. Boeckman, Pasadena.

Colorado

State Dental Board Appointees: The following will serve on the state board of dental examiners: W. C. Davis, Alamosa; Z. T. Roberts and J. J. O'Neil, Denver; W. H. Flint, Littleton (reappointed); E. W. Spencer, Pueblo (reappointed).

State Society Meets: The annual convention of the Colorado State Dental Association was held in Colorado Springs, June 15-18, with about 500 members in attendance. F. V. Simonton, San Francisco, opened the scientific program with a paper on "Tissue Changes in Periodontoclasia." Other essayists were Dayton Dunbar Campbell, Kansas City; Arthur G. Kelly, Denver; John W. Seybold, Denver; A. C. Driehaus, Colorado Springs; Willis A. Coston, Kansas City; Polk E. Akers, Chicago; and George R. Warner, Denver.

Georgia

Annual State Society Meeting: The annual meeting of the Georgia State Dental Society was held, June 15-17, at Albany, with three hundred members in attendance. H. L. Banzhaf, President of the American Dental Association, addressed the general session, Wednesday evening, June 15, on the subject "Will Dentistry Seize Its Present Opportunity?" The comprehensive program of clinics which was presented was under the supervision of C. W. Hoffer, Nashville, Tenn., and M. D. Huff, T. B. Sharp, Thomas Conner, I. M. Hair and J. W. Lynn, all of Atlanta. At the closing session, the following were elected as officers for the ensuing year: president, J. Russell Mitchell, Atlanta; president-elect, W. B. Childs, Macon; treasurer, B. K. Vann, Atlanta; secretary, G. A. Mitchell, Atlanta (reelected). The next annual meeting will be held in Atlanta.

Idaho

Board of Dental Examiners: The state board of dental examiners for 1927-1928 is composed of the following members: H. B. Colver, Boise; S. S. Evans, Preston; J. F. Johnston, Twin Falls; L. D. Blondell, Caldwell, and Ira R. Boyd, Moscow.

Kansas

Members of State Dental Board: The following are the appointees on the Kansas State Board of Dental Examiners: president, John L. Parkhurst, Humboldt; vice-president, C. V. Hope, Topeka; secretary-treasurer, George E. Burkett, Kingman.

Louisiana

New Members of State Dental Board: Elected to the Louisiana State Board of Dental Examiners are the following: president, Rex Matheny, Alexandria; vice-president, Philip M. Gayle, Monroe; secretary, Sidney F. Gauthier, New Orleans.

Maryland

Appointed to Dental Board for Six Years: E. A. Coble, of Easton, and J. S. Hopkins, of Belair, have been appointed to serve for six years on the Maryland State Board of Dental Examiners.

Mississippi

Annual Session of State Society: The fifty-second annual session of the Mississippi Dental Association opened, June 16, at Gulfport. The newly elected officers are: A. A. Allen, Amory, president; C. K. Bailey, Grenada, vice president; B. B. Kennedy, Jackson, treasurer; C. A. Moore, Lexington, secretary (reelected).

Missouri

St. Louis University Commencement: St. Louis University completed its one hundred and ninth year with the conferring of degrees at the commencement exercises, June 6. Daniel William O'Donoghue, Ph.D., LL.D., addressed the graduates. Sixty-four candidates received the degree of doctor of dental surgery, thirty-nine of whom were commissioned as first lieutenants in the Officers' Reserve Corps of the United States Army.

Gift for Dental Clinic: A dental clinic has been made possible at the University of Missouri through the generosity of Mr. J. Dozier Stone, of Columbia. The clinic is to stand as a memorial to the parents of the donor, and will provide for the dental care of children entering the orthopedic department, which is to be opened simultaneously with the dental clinic.

Washington University Commencement: The sixty-sixth commencement of Washington University, St. Louis, was held June 7, with Charles G. Dawes, Vice-President of the United States, as the speaker of the occasion. Sixteen students received the degree of doctor of dental surgery. Honors in the school of dentistry were conferred on Charles Eugene D'Oench, Lindell DeWitt Straabe and Theodore Jacob Winkler.

Montana

Dr. Finlayson to Hawaii: Max T. Finlayson, of White Sulphur Springs, has entered practice in Honolulu, after practicing in Montana for nearly ten years.

New Hampshire

State Society Elects Officers: At the close of the recent annual convention, the following were elected officers for the ensuing year by the New Hampshire Dental Society: president, Clarence J. Washburn, Concord; vice-president, A. W. Woodman, Plymouth; secretary, William J. Molles, Manchester; treasurer, William A. Young, Concord.

State Society Meeting: The fiftieth annual meeting of the New Hampshire Dental Society was held in Plymouth, June 8-9. Those presenting clinics were W. I. Brigham, Framingham, Mass.; Arthur A. Blondin, Manchester; James P. Ruyl, New York City; W. G. Bridge, Boston, Mass.; Irvin H. Ante, Toronto, Canada; John W. Bowler, Hanover; Eudore Dubeau, Montreal, Canada; J. H. Kiniry, Manchester, and F. L. Bulfinch, Manchester.

Ohio

Northern District Association Meets: More than 250 members were in attendance at the seventieth annual convention of the Northern Ohio Dental Association in June. Speakers of the occasion were E. V. McCollum, Baltimore; Edward W. Kennedy, New York City; I. Lester Furnas, Cleveland; Weston A. Price, Cleveland; Howard C. Miller, Chicago; K. W. Knapp, Minneapolis; J. K. Burgess, New York City; J. M. Prime, Omaha, and Harris R. C. Wilson, and L. S. Karnosh, Cleveland. Following are the newly elected officers: president, Thomas J. Hall, Cleveland; president-elect, E. S. Braithwaite, Willard; secretary, W. S. Sargent, Toledo; treasurer, R. J. Armstrong, Cleveland.

Pennsylvania

Dr. McQuillen Honored: Daniel Neall McQuillen, son of the founder of the old Philadelphia Dental College, was the guest of honor at a banquet given by a group of professional associates to commemorate his completion of fifty years of continuous service in the dental profession. L. Norman Broomell presided and E. C. Kirk acted as toastmaster.

Tennessee

Appointed to State Dental Board: H. A. Graves, Nashville, and J. H. Meeks, Humboldt, have been appointed members of the state board of dental examiners, to serve three years.

Vermont

State Society Elects Officers: At the close of the fifty-first annual conference of the Vermont State Dental Society the following officers were elected: president, R. D. Jenny, Rutland; vice-president, George D. Samson, Burlington; second vice-president, Carter R. Wood, Rutland; secretary, Lloyd C. Robinson, Morrisville; treasurer, Howard F. Killary, Burlington.

CURRENT LITERATURE

EXTRACTS AND ABSTRACTS

Physical Defects in a Thousand Children: In a study of 1,000 children, of three social groups, to determine the effect of physical defects on growth, earlier data as to the significance of nasopharyngeal obstructions as a cause of underweight and physical unfitness are fully confirmed. (W. R. P. Emerson, *Am. J. Dis. Child.*, May, 1927.) In general, the presence of a greater number of defects is associated with less gain in weight. The most striking difference noted between the group of children from private practice and the institution group and the hospital group was the better care of the teeth of the former. The author comments on this phase of the investigation as follows: "From the observations arising from the data concerning the children in the group in my private practice, it appears that care of teeth has made great progress during recent years in American families who live on higher economic levels. Not only are the members of the dental profession more adequately equipped than was the case a few years ago, but also both they and the parents have a much higher standard, which is well carried into effect. This standard is working its way down the economic scale, and increasingly wide ranges of families are coming to expect as a matter of course that hygiene of the mouth will be well attended to. An encouraging development in this connection is the tendency of dentists and orthodontists to see the problems of the care of their patients in direct relation to health diagnosis and health intelligence. There is still too much strain put on children undergoing dental care, especially when oral deformities have developed because of obstructed breathing and similar causes. When, however, a dentist examines a child every six months, he is able to come to a better understanding of health as a whole and to take responsibility for something more than the mere correction of outstanding oral defects."

Window Glass That Admits Health Rays: Materials for glazing windows that will not exclude the health-giving rays of sunlight seem now to be available, concludes a report of the council on physical therapy of the American Medical Association. Experiments made on chicks showed that the substitute materials transmitted an amount of ultraviolet rays sufficient to have the same biologic effect as daily exposure of fifteen minutes to the light from a mercury vapor arc at a distance of 1 meter. The materials examined were Corning Glass, Vitaglass, Celoglass and Flexoglass. The last two are not transparent and while they are less expensive than ordinary window glass, Flexoglass does not stand the onslaught of the weather as well as Celoglass. This material is intended primarily for use in animal husbandry and is satisfactory for use in the winter; in summer when it tends to soften and collect dust, it may be removed.—*Hygeia*, July, 1927.

Nonvenereal (Metastatic) Genital Infection: In two of seven cases reported by Theodore Baker (*J.A.M.A.*, June 25, 1927), badly diseased teeth were found to be responsible for attacks of prostatitis. The majority of the cases were traced to furuncles or carbuncles, and one case was attributed to a stitch abscess in an abdominal wound.

Danger of Irradiating Foods: Drummond has pointed out the unexpected short-comings of the irradiation of the mammary secretion. Milk that has been exposed to the radiations of a mercury vapor lamp for as short a time as five minutes not only becomes unpalatable, in that it acquires and unpleasant, tallowy odor, but also suffers chemical changes highly undesirable from the standpoint of nutrition. Of these, one is the destruction of vitamin A by oxidation. The use of such a deteriorated product might lead to a shortage of vitamin A in children dependent on milk through an attempt to enrich their diet with vitamin D.

The correspondent wisely commented that the tendency to apply somewhat generally the results of laboratory research before they are ripe for practical use is to be regretted. Considerable experimental work remains to be carried out before the conditions have been determined under which so labile and complex a foodstuff as milk can be subjected to the powerful action of ultraviolet or other irradiation without serious impairment of nutritive value. The same caution may apply to other food products soon likely to be offered for sale in an irradiated condition.—*J.A.M.A.*, May 7, 1927.

Radium in Carcinoma of Mouth and Throat: Salinger (*Arch. Phys. Ther. X-Ray. Rad.*, June, 1927) discusses the limitations of radium in the treatment of mouth and throat carcinoma. The physiologic and physical phases of its use must be understood. Radium is less effective and more dangerous than the roentgen ray in the treatment of deep seated lesions because (1) the maximum effect is manifest on the healthy surface tissues and (2) the direction of radium rays cannot be controlled. For these reasons, the effectiveness of radium as a therapeutic agent is greatest in superficial lesions. The effectiveness varies according to the tissue exposed. The author finds this experience substantiating that of Ewing in that tumors of embryonal character are particularly susceptible to radiation. Ewing's classification according to this susceptibility is as follows: 1. Lymphoma, lymphocytoma, lymphosarcoma, myeloma. 2. Embryonal tumors: carcinoma of testis and ovary. Basal cell carcinoma. 3. Cellular neoplastic adult tumors. Round-cell carcinoma. Diffuse carcinoma. 4. Desmoplastic tumors: carcinoma simplex, fibro-carcinoma, squamous carcinoma. 5. Adenocarcinoma: adenoma of uterus, intestine, breast. 6. Fibro-plastic carcinoma. Osteocarcinoma, neurocarcinoma. In lesions of the mouth and pharynx, surface application or inplantation can be employed. The method of choice in carcinoma of lip or cheek is surface application, either by contact or at a distance of several centimeters, and with exposure for from one to three hours, repeated in two weeks if necessary. Implantation is employed in lesions of the tongue, pharynx and sometimes larynx. Neighboring lymphatic glands are also irradiated, whether enlarged or not. Malignant areas of tongue and tonsil are easily treated by implantation. The nearer the tongue growth is to the midline, the more favorable the prognosis, as a rule. The author considers the outlook for carcinoma of the tongue extremely optimistic if the lesion is attacked early, before metastasis occurs. Carcinoma of the tonsils, base of the tongue and pyriform fossa are inoperable, but nearly 25 per cent yield to radium therapy. The typical treatment consists in implantation of glass or gold tubes. The author concludes: 1. A majority of the malignant lesions of the mouth and throat (including the strictly intrinsic carcinoma of the larynx) are inoperable. 2. Such cases, unless too far gone, are proper material for radium treatment. 3. The extent and type of the lesion must be carefully studied and an attempt made to thoroughly irradiate it along with its neighboring lymphatic glands. 4. Implantation with bare emanation seeds or the gold implants has proved satisfactory in our hands when the lesion is accessible and the surrounding structures capable of withstanding the reaction.

Malformed Maxillary Cuspid: A case of malformed maxillary cuspid in a girl, aged 16, is described by J. H. Nicholson (*New Zealand Dent. J.*, May, 1927). The patient had suffered from severe headaches for four years, spasmodic in character, of short duration and accompanied by shooting pains in the left side of the face. After a general examination, which revealed various small fillings and cavities, a detailed examination showed a greater response to percussion in the cuspid and, on palpation, "bogginess" of the mucous membrane and tenderness over the apices of the cuspid and bicuspids. The mucous membrane was injected and two sinuses were present, apparently arising from the lateral incisor and from a bicuspid. Procain was injected and diagnostic wires were inserted in the sinuses. A roentgenogram revealed that each sinus came from the cuspid, leading from separate and distinct foramina. The cuspid had two independent root canals. On its extraction, there was total remission of pain. A minute amalgam filling had encroached on the recessional lines of the pulp, and secondary dentin had formed, causing strangulation of one pulp canal, with gangrene resulting. The canals were situated mesially and distally, and not lingually and labially, as might be expected.

Announcements

CALENDAR OF MEETINGS*

NATIONAL SOCIETIES

American Academy of Periodontology, October 20-22, 1927, Detroit, Michigan.

American Dental Assistants Association, October 25, 26, 27, 1927, Detroit, Michigan.

American Dental Hygienists Association, October 24-28, 1927, Detroit, Michigan.

American Dental Association, October 24-28, 1927, Detroit, Michigan.

American Dental Trapshooters League, October 24-28, 1927, Detroit, Michigan.

American Society of Oral Surgeons and Exodontists, October 21-22, 1927, Detroit, Michigan.

American Dental Society of Europe, August 1-3, 1927, Paris.

International Dental Federation, August 6-9, 1927, Copenhagen.

Sixth Australian Dental Congress, August 22-27, 1927, Melbourne, Australia.

STATE SOCIETIES

District of Columbia, at George Washington University, Washington, D. C., second and fourth Tuesdays in each month from October to June inclusive.

September (1927)

Maryland, at Hagerstown (12-13).

October (1927)

Florida, at St. Petersburg.

December (1927)

Ohio, at Cleveland (6-8).

February (1928)

Minnesota, at Minneapolis (Feb. 29-March 2).

March (1928)

Louisiana, at Shreveport.
Montana, at Missoula (29-31).

April (1928)

California, Stockton (9-12).
Maryland, at Baltimore (April 30-May 2).
North Carolina, at Greensboro (16-18).

*Announcements must be received by the ninth of the month in order to be published in the forthcoming issue of THE JOURNAL.

MEETINGS OF STATE BOARDS OF DENTAL EXAMINERS

National Association of Dental Examiners, at Detroit, Michigan, October 22, 1927. Secretary-treasurer, George L. Powers, Memphis, Tennessee.

MARYLAND STATE DENTAL ASSOCIATION

The forty-fifth annual meeting of the Maryland State Dental Association will be held at the Belvedere Hotel, Baltimore, April 30-May 2, 1928.

The fourth semi-annual meeting of the Association will be held at Hagerstown, Maryland, Sept. 12-13, 1927.

NORVAL H. MCDONALD, *Secretary*,
304 Morris Bldg.,
Baltimore, Md.

NORTH CAROLINA DENTAL SOCIETY

The next meeting of the North Carolina Dental Society will convene in Charlotte, at the Charlotte Hotel, April 16-18, 1928.

DENNIS KEEL, *Sec'y-Treas.*,
Greensboro, N. C.

Some Package Libraries Compiled by, and Available for Circulation from
THE DEPARTMENT OF LITERARY RESEARCH

American Dental Association

Procain dermatitis.
Alveolectomy, or surgical preparation of the mouth for dentures.
Dental ethics.
Amalgam fillings.
Local anesthesia.
Comparative dental anatomy.
The business side of dentistry.
Value of oral health and how to obtain it.
Use of elevators in extraction.
History and progress of dentistry.
Anatomic articulation.
Pedodontia.
Porcelain inlays.
Relation between mouth-breathing and the restricted arch.
Traumatic occlusion.
Focal infection.
Apicoectomy.
Calcium metabolism in relation to teeth.
Suggestions for a talk to a mothers' meeting.
Interpretation of dental radiograms.
Some problems of children's dentistry.
Ultra-violet ray in the treatment of pyorrhea.
Dentist as an aid to public health.
Surgical treatment of pyorrhea.
Vincent's infection.
Prevention of shrinkage of gold inlays.
Hospital dental service.
Diet and nutrition in relation to dental defects.

Each package library may be kept for one week after date of receipt. The charge is fifty cents a package. Packages are composed of reprints, clippings from magazines, and pamphlets; the average package contains between twelve and twenty articles. In response to requests, packages will be made up pertaining to any phase of dentistry.

FIRST DISTRICT DENTAL SOCIETY STATE OF NEW YORK

The First District Dental Society announces its third *Better Dentistry Meeting*, to be held at the Hotel Pennsylvania, New York City, Dec. 5-7, 1927. In conjunction with this meeting, a dinner will be tendered William Dwight Tracy in recognition of his contribution and unselfish devotion to the profession. Detailed information will be published at a later date.

ALFRED WALKER, *Chairman*,
100 W. 59th St.,
New York City.

TO PEDODONTISTS

If you are limiting your practice to the care of children or if you know of any dentists in your community engaged in this specialty, will you please forward this information to the Detroit Pedodontic Society.

S. D. HARRIS, *Secretary*,
Pedodontic Study Club of Detroit,
412 Kresge Bldg.,
Detroit, Mich.

UNIVERSITY OF TORONTO FACULTY OF DENTISTRY—ANNUAL COURSE FOR DENTAL PRACTITIONERS

The annual course for dental practitioners is to be held this year for one week, commencing Monday, September 12. This is the week immediately following the Canadian National Exhibition, which will be held from August 27 to September 10.

All registrants are expected to attend the general sessions comprising 20 lectures as follows:

Clinical Dentistry and diagnosis	2 lectures
Dental surgery and anesthesia	5 lectures
Preventive dentistry	5 lectures
Orthodontia for the general practitioner	2 lectures
Dental praxis	3 lectures
Periodontia	3 lectures

The class will be divided into groups for laboratory work, demonstrations and clinical practice.

Applications will be received by mail but all registrants should be present at the Dental Building, 240 College St. (corner Huron St.), at 9:00 o'clock on the morning of Monday, September 12. The opening lecture will be given at 9:30 a. m.

Graduates may avail themselves of the facilities of the Faculty library to secure books, for study previous to or during the progress of the course.

Registration forms will be forwarded on application to the Secretary, Faculty of Dentistry, 240 College Street, Toronto 2, and should be returned by August 20.

WALLACE SECCOMBE,
Dean

PATENTS OF INTEREST TO DENTISTS

1500615. Anesthetizing apparatus, Jay A. Heidbrink, Minneapolis, Minn.

1500398. Sanitary dental supply holder, Louis Kusnetz, Chicago, Ill.

1500155. Dental flask, W. M. Romaine and W. J. Clark, Wichita, Kan.

1502446. Dental swaging device, S. J. Symmons, San Francisco, Calif.

1502366. Die plate for dental bridgework, James A. Wright, Chicago, Ill.

1503313. Artificial tooth, W. B. Floyd, Denver, Colo.

1503050. Rotary toothbrush, A. H. Jurk, and P. Syracuse, Buffalo, N. Y.

1503063. Dental appliance, G. E. Perry, Chicago, Ill.

1502970. Artificial denture, A. S. Van Houten, Newark, N. J.

1502971. Toothbrush, Abraham Wallace, Oakland, Calif.

1502814. Dental casting machine, Martin F. Burns, Flushing N. Y.

1503580. Dental tray, Albert M. Epstein, Elmira, N. Y.

1503528. Local anesthesia outfit, F. J. Fabert, Nice, France.

1504143. Toothbrush, W. E. Roberts, Kenosha, Wis.

1503610. Dental tool, Robert B. Smith, Broken Bow, Nebr.

1504942. Orthodontic appliance, T. M. Comegys, Shreveport, La.

1504343. Dental mirror, Joseph G. Heard, Atlanta, Ga.

1504904. Anchor for lower dentures, Theodore Roxbury, Brooklyn, N. Y.

1504906. Articulator, Carl Rumpel, Berlin, and H. Schroder, Berlin-Westend, Germany.

1505684. Dental instrument, F. A. Ainsworth, St. Johns, Canada.

1505309. Dental mandrel, Ira A. Burnett, Chicago, Ill.

1507466. Toothbrush holder and sterilizer, Walter H. Collins, Summit, N. J.

1507476. Method and apparatus for making dental crowns, Joseph M. Flanigan, Shamokin, Pa.

1507313. Dental floss holder, Charles E. Hudson, Leominster, Mass.

1507185. Fountain cuspidor, Fred F. Jones, Chillicothe, Ohio.

1507500. Toothbrush, Silas W. Metz, Connellsville, Pa.

1507024. Artificial tooth, Carlton I. Monson, Denver, Colo.

1507519. Dental plate, Lars J. Rud, Herning, Denmark.

1507947. Dental clasp, Hugo Aderer, East Orange, N. J.

1507823. Artificial tooth structure, Joseph A. Gardner, Memphis, Tenn.

15911. Reissue, sanitary mouthpiece, Nathan Gleb, Newark, N. J.

Copies of the foregoing patents may be obtained for twenty-five cents each, by addressing John A. Saul, Solicitor of Patents, 509 Seventh St., N. W., Washington, D. C.